PERIODICAL ROOM GENERAL LIBRARY UNIV. OF MICH.

A STUDENT DISCOVERS AMERICA

DISCOVERY

A Monthly Popular Journal of Knowledge

Vol. VII, No. 83. NOVEMBER, 1926 (Annual Subscription 12s.6d. Post Free). PRICE 1s. NET

A DECORATED HOLY WELL AT EDLASTON, DERBYSHIRE.

CONTENTS

	Pages.
Editorial Notes	369
Livy as a Politician	371
Researches on the Flight Factor in Birds	377
Correspondence	380
Discovering American University Life	382
The Preaching of the Crusades in America...	386
Holy Wells in Legend and History	389
Scientific Problems of the Amazon Valley	394
The Month's Wireless Developments	397
Book Reviews	398

Remington Portable Typewriters are being assembled by **British Labour** at the **London Factory** of the Remington Typewriter Co. Ltd.

Write for full particulars "D"

The Remington Portable is the most compact of all Portable Typewriters—fitted with the standard fourbank keyboard, automatic ribbon reverse.

Remington

PORTABLE TYPEWRITER

will be sent on receipt of

£2 : 2 : 0 with order

The balance can be paid by eleven monthly instalments of £1.

THE REMINGTON TYPEWRITER CO. LTD.,
Head Office: 100, Gracechurch Street, London, E.C.3
And at **4 St. Paul's Churchyard, London, E.C. and 83 Regent Street, W.1.**
Branches in principal provincial centres.

WHITE STAR LINE

WINTER CRUISES

ROUND THE WORLD
WEST INDIES MEDITERRANEAN

BELGENLAND
27,200 Tons

HOMERIC
34,351 Tons

ADRIATIC
24,541 Tons

DELIGHTFUL HOLIDAY TOURS TO U.S.A. AND CANADA

3 to 4 weeks from £35 return.

For full particulars, booklet, etc., apply to Company's Offices—
LIVERPOOL: LONDON—1, Cockspur St., S.W.1, and 38, Leadenhall St., E.C.3; SOUTHAMPTON; BIRMINGHAM; MANCHESTER; BRISTOL; BRADFORD; GLASGOW; BELFAST; DUBLIN; COBH (Queenstown); or Local Agents.

The R.M.S.
"Hildebrand"
will Sail from
LIVERPOOL
on
November 23rd
also alternate months,
March—November, 1927.

卐 卐 卐

Visiting picturesque Portugal, Madeira, the Garden Island of the sea, and the mysterious forest of the great Amazon.

卐 卐 卐

A CRUISE OF 11,800 MILES ON SUMMER SEAS

Write for Illustrated Booklet of these six-weeks' cruises to Dept. "D."
THE BOOTH LINE
11 Adelphi Terrace,
LONDON, W.C.2
Cunard Building,
LIVERPOOL.

卐 卐 卐

FARE FROM
£90

卐 卐 卐

Less than 2d. per mile including the Cuisine of a First-class Floating Hotel.

DISCOVERY

A Monthly Popular Journal of Knowledge

Vol. VII. No. 83. NOVEMBER, 1926. PRICE 1s. NET

Trustees: Sir J. J. Thomson, O.M., F.R.S., Sir F. G. Kenyon, K.C.B., F.B.A., Professor A. C. Seward, Sc.D., F.R.S., Professor R. S. Conway, Litt.D., F.B.A.

Edited by John A. Benn.

Publishers: Benn Brothers, Ltd. All communications respecting editorial matters to be addressed to the Editor: all questions of advertisements and subscriptions to the Manager.

Offices: 154, Fleet Street, London, E.C.4.

Telephone: City 0244 (10 lines).

Telegrams: Benbrolish Fleet.

Annual Subscription, 12*s.* 6*d.* post free anywhere in the world. Single numbers, 1*s.* net; postage 2*d.*

Binding cases for Vol. VI, 1925, can still be obtained. Price 2*s.* 6*d.* net each; postage, 6*d.*

Editorial Notes.

In view of the tendency for science to claim an ever larger share in the necessarily limited hours of the school curriculum, a more timely subject than the value of classics in education could not have been chosen by the Lord Chief Justice for his presidential address to the Classical Association a few weeks ago. The purpose of that body, as Lord Hewart pointed out, is to develop and maintain the well-being of classical studies—not in the least to defend them. Nevertheless, his clear statement of their importance, in particular in relation to present-day problems, was welcome to many besides those to whom the teaching of classics is their primary concern. If the scientist sometimes shows a scarcely veiled contempt for what he terms the "dead" languages, the classicist is perhaps inclined to lay too much emphasis on the materialistic aspects of the progress of science. Yet the close relation of each to the other was cogently expressed by Lord Hewart in reminding us that the Greeks first conceived the idea of a rational life.

It is sometimes said that this complex age has nothing to learn from the Greeks because, for example, they knew nothing of Science with a big S, or of the problems of a scientific and industrial civilization. But the statement is, in Aristotle's phrase, manifestly at variance with notorious facts. The great value of the Greeks was that their life was simple, and their minds were courageous and free, and therefore with clear vision they faced all the essential problems of humanity. "Life, said Aristotle, is reason in operation. Life without inquiry, said Socrates, is not worth living."

* * * * *

At the conclusion of the annual meeting, which was held this year at Manchester, Professor R. S. Conway was elected President of the Classical Association in succession to Lord Hewart. In recalling that the retiring president followed the Prime Minister in this important office, the reader will be conscious of the further distinction that the new appointment adds to the academic connexions with which *Discovery* is associated. As honorary secretary of the Trustees of *Discovery*, Professor Conway has been tireless in his efforts on its behalf. The first practical steps in its foundation were taken under his guidance; and despite his many duties in the Classical School of Manchester University, he has devoted to the cause of the journal an interest whose value can only be fully appreciated by those who have occupied the editorial chair. In taking the opportunity that his new appointment affords of recording our appreciation of Professor Conway's services, we may express the hope that in the interests of its progress *Discovery* may long continue to have the privilege of his co-operation.

* * * * *

One word more on the subject of classics. Lord Hewart suggested that besides being a record of the past the classics are a complete anticipation of most of the problems of criticism and construction which face the world at the present time, and he instanced certain political considerations. While partisan controversies are outside the scope of *Discovery*, we publish in this issue an account of the interesting discovery by Professor Conway of a political point of view in the writings of Livy which he believes has not been observed hitherto.

* * * * *

The discovery that the X-ray may successfully be used to detect forgeries in oil paintings has been made in the United States, where many masterpieces are being analysed in this way. The method was

developed by the Fogg Museum at Harvard University, where a number of paintings thought to be original were discovered to have been retouched and even repainted; one picture, apparently an excellent fourteenth-century specimen, was shown by the X-ray to be a modern forgery, and it has now been hung in the New York Metropolitan Museum of Art as a warning to collectors. The work is described in *The Italian Mail* in connexion with a visit which an official of the Fogg Museum, Mr. Alan Burroughs, is making to the Louvre and the Berlin Museum, where pictures by Raphael, Velasquez, da Vinci, and other famous masters will be examined to obtain evidence of their technique. The results may be used later in tests to decide the authenticity of other works, the great value of the X-ray, according to Mr. Burroughs, being that it shows the character of the under-painting or the preliminary work done by the artist before the surface was finished. It is reported that satisfactory standards have already been established for judging the work of Rembrandt, though in cases where a master worked in conjunction with many pupils analysis may be particularly difficult. The principle of this new discovery, as applied to detecting forgeries, is stated to be that while the X-rays are stopped by the mineral colours which were formerly used, so that the painting appears as a shadowgraph, the vegetable colours employed in modern work are transparent to their light. It is thought that the method may also prove of value in detecting "fake" furniture.

* * * * *

The wooden mount of an early horn-book that was possibly once in the possession of Shakespeare has been brought to light during alterations in Anne Hathaway's Cottage at Stratford-on-Avon, the discovery being announced in *The Times* of 8th October by Mr. Frederick Wellstood, secretary and librarian to the Trustees of Shakespeare's Birthplace. Owing to the fact that some 60,000 tourists now visit the building every year, it was recently decided to make the whole available for public inspection by removing certain structures, including a staircase, which were not of original date. The taking down of a lath and plaster partition, erected a century ago, in a room containing the Elizabethan bedstead of the Hathaway family, revealed a small open space under the floor between the joists. Before making good the gap it was thought desirable to clear out the dust and rubbish accumulated during the ages, and in doing so the architect in charge discovered among the debris a piece of oak, which proved to be a horn-book mount. Its interesting feature is the presence, on the back, of carved initials, and although these are variously read by the experts as "W. S." and "W. B.," the photograph we reproduce on another page is certainly suggestive of the more interesting interpretation. The circumstances in which the discovery was made dispel any suspicion of forgery; and the mount is stated to present every appearance of being as old as the time of Shakespeare.

* * * * *

In addition to the appreciations we have received from readers of the wirelesss feature started in our pages six months ago, some figures have reached us indicative of the value it has afforded to our advertisers. It is satisfactory to learn that Mr. A. W. Reeves, whose announcement has appeared regularly since our first instalment was published, has now combined business with the Productive Grinders Ltd., of Birmingham, in order to keep pace with the demand for his apparatus, which has found many new users through the medium of *Discovery*. Editorial discussion of this aspect of the wireless pages will not be misunderstood when we mention it has confirmed our anticipation that the feature would supply a definite need. It was felt that many are deterred from taking full interest in broadcasting, no less than in technical matters, for want of an expert record of monthly developments, yet written in non-specialist language. In appealing primarily to those of a mechanical turn of mind, the ordinary literature of the subject overlooks the important section of the public which has neither time nor inclination to regard wireless merely as an experimental hobby. That the majority of *Discovery* readers belong to this category is apparent; and we are confident that firms taking advantage of the opportunity our pages afford to promote their business "outside the groove" will meet with the support their discrimination deserves.

Readers who listen-in will have been interested to hear quotations from *Discovery* in a talk broadcast from London one evening last month. Under an arrangement then introduced for the first time, the British Broadcasting Company will review certain representative publications and this journal has been selected for regular notice in the wireless programme. While welcoming the wider interest this new feature will create, we are pleased to record this further recognition of the position of *Discovery*.

* * * * *

The date of the discovery of the celebrated gold cups of Vaphio, mentioned last month in these columns, was printed in error as 1899. It should, of course, have read 1889.

Livy as a Politician.*

By R. S. Conway, D.Litt., Litt.D., F.B.A.

Hulme Professor of Latin in the University of Manchester; President of the Classical Association.

The following new study of Livy's account of the tragic history of Philip V of Macedon reveals a political point of view which has not hitherto been observed as being anywhere expressed by that author.

A COMPLAINT is sometimes made, though not by schoolboys, that there is too much fighting in Livy's history; and for that impression there is no doubt some excuse in the early Books. But no one who has read through the magnificent story of the Punic War in the Second Decade, with its great portraits of Hannibal, Marcellus, Scipio, and many more, would be at all inclined to join in the complaint; nor would the criticism be just of the Fourth Decade, which contains the troubled story of the forty years that followed. In this story too there is plenty of military stuff which indeed to the average Roman reader of history was, so to speak, the staff of life, the real central interest of the past; but there is also a series of great portraits, and one almost continuous line of narrative, full of personal interest, worked out through the ten Books with the earnestness and dignity of a tragic drama. And in this story, more than in any other part of his writings, Livy makes quite clear a political point of view which has not, I think, been yet observed. The object of this article is to consider this aspect of the tragedy as Livy tells it.

Philip V of Macedon.

The central figure in the story of the ten Books is Philip V of Macedon. His character is traced in the struggle that he maintained, never with complete success but always escaping complete defeat against the dangers that beset his throne in the first twenty years of his reign—that is, the last twenty of the third century B.C.

The personality of Philip is complex enough to challenge the historian. At bottom he was a barbarian, but among barbarians he was distinguished not merely by touches of statesmanship and even of clemency, but by his comprehension of the motives which governed the conduct of nobler men. The tragedy of his life lay in the conflict between his barbarian instincts, worthy of any Turkish Sultan, and the force of liberal principles which the Romans had learnt from Greek writers and were then applying with enthusiasm to the new provinces now at their feet. Had there been no Romans, Philip's career might have resembled that of his great predecessor Alexander, and the Empire he would have established, though no doubt less extensive, might have lasted longer. But his life was wrecked on these new factors in the world—the power of Rome, and the faith in free government which animated the leading Romans of that day.

Great qualities in Philip appeared in the Second Macedonian War which the Romans declared, after much hesitation, in 200 B.C. His daring courage was displayed in the battle of Octolophus, where he escaped death only by the devotion of one of his troopers, who gave the king his horse but was himself at once cut down. Nor did it need less courage to persevere in his resistance to Rome after he had failed to secure support from other Greek states to whom he appealed. His sinister diplomacy appeared in an ingenious attempt to secure possession of Corinth and other strong places of Achæa under pretext of making war against the Spartan tyrant, Nabis—an attempt frustrated by the courage of the magistrate presiding over the Achæan assembly, who ruled the king's application out of order, because it had not been circulated on the agenda. After his first defeat by Flamininus he began negotiations for peace; but in the colloquy the chief magistrate of the Ætolians, who happened to be very short-sighted, broke in upon Philip's speech, declaring that the king must either accept the terms offered him or else win the war. "Yes," said Philip, "it needs no eyes to see that." This retort, adds the grave historian, was too pointed to be seemly for a king—but Philip was always like that.

The war continued until Flamininus' great victory in 197, when Philip showed his prudence by offering humble terms of submission, and gave many hostages—among them his own son Demetrius, a boy of twelve, who was taken to Rome, and remained there for six years. Philip's submission involved the surrender of his strongholds in the mainland of Greece, and this was publicly announced, to the almost incredulous delight of the Greeks assembled for the Games at Corinth, in 196 B.C. But all this did not break the king's spirit; for when Macedon itself was invaded

* This article is based by kind permission on one in the *Bulletin of the John Ryland's Library* (July, 1926), and on a lecture at King's College, London, on 22nd October. The translations from Livy are based on Philemon Holland's.

by a neighbouring tribe, he raised a new army and drove them out, for "to lose any part of Macedon he counted a crueller fate than death."

Six years later (190 B.C.) the two Scipios went out to carry the war against Antiochus into Asia, and they found Philip thoroughly friendly, preparing all the roads and supplies needed for their armies. But after Antiochus had been finally worsted and the affairs of Greece had to be settled again, Philip was chagrined to find that the Roman policy remained exactly what it had been, and that he was now required to evacuate several Greek towns in Thrace which he had been allowed in the war to occupy.

However, he felt himself not yet strong enough for open war, and in 183 B.C. sent his son Demetrius (then twenty-five years old—he had come home in 191 B.C.) back to Rome to plead for him; and to Demetrius the Senate showed the utmost courtesy, though he found it difficult to make out his father's case, and only succeeded in producing the notes which his father had given him and which had been discreetly composed in general terms. The Senate thereupon resolved to thank Philip for having sent his son, and to inform him that they accepted the pledges which Demetrius offered because of their confidence in the young prince himself, whom they knew to be a friend of the Roman people so far as his loyalty to his father would permit; and Philip was to understand that he owed their continued friendship largely to their esteem for Demetrius. This message, sent to do honour to Demetrius, had some effects which the Senate did not foresee.

On his return to Macedon Demetrius was received with great favour by the multitude, who looked on him both as the author of the peace, and through the favour of Rome, as the most likely successor of his father, especially because his elder brother Perseus was not a legitimate son of Philip, and had none of the personal likeness to the king which was conspicuous in Demetrius. Perseus naturally regarded the position of affairs with other eyes; and so did Philip. Nevertheless, he submitted to the terms which Demetrius brought, and the stage was set for the final acts of the tragedy.

Weakness of Autocracy.

The theme round which the tragedy centres is the inherent weakness of autocracy, what Tacitus calls *inopia veri*, that the autocrat can never be sure of knowing the truth. This theme is characteristically Greek. But like conditions produce like effects; the courts of the Claudian emperors in the first century A.D. were infested by secret intrigues for deceiving the emperor, of which Tacitus has drawn a grim picture. And we know that even under Augustus in one case something of the same weakness in the imperial system had appeared, for it is probable that the folly of Gallus in 26 B.C. had been gravely exaggerated, and one cannot help asking whether Livy was conscious of this in writing his tragedy of the Macedonian despot.

At all events, by keeping such a question in mind we shall be watching the drama in a temper not very unlike that which Livy avowed in the preface to his whole work, when he described his own time as one in which Rome had grown so great that she "could endure neither the corruptions of her government nor their remedies," *i.e.*, the imperial system.

The whole story of Philip turns on the conflict between his ambitions and the ideals of Rome. Could he only have brought his proud spirit to live without trespassing on the freedom of his neighbours, he might have died at least a comparatively happy man. By having his own way he doomed himself to years of remorse, ended only by his death; and his subjects to the rule of a tyrant ended only by their complete disappearance as a nation. As a kind of keynote to the culmination of the tragedy in the fortieth Book, Livy sets a grim story of Philip's cruelty towards some of his own subjects. Philip openly avowed that he was acting on a saying ascribed to an ancient poet, and often quoted, that only fools would kill a father and leave his sons alive. Philip had put to death a leading citizen of Thessaly and his two sons; the widow of one of the sons died; the other widow, in charge of her own and her sister's children, killed them all and her second husband and herself, as the only escape from Philip's order of arrest, which she knew meant death for the elders and nameless slavery for the children.

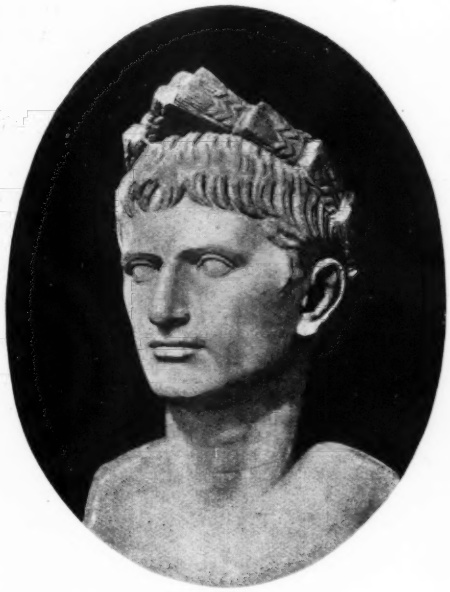
Livy then resumes the narrative where it had been left on the return of Demetrius from Rome (in 183 B.C.). Perseus, seeing his brother's great popularity, took the course that seemed natural to his barbarian instincts, and began to plot for his destruction.

> "Now at first some of Philip's counsellors would not consent to hear of any such thing, because they had better hope of Demetrius. But afterwards, as the hatred of Philip against the Romans, which Perseus still fostered, grew daily greater—whereas Demetrius with all his might laboured against it—foreseeing in their minds the unhappy end of Demetrius, who was not heedful enough to guard himself against his brother, they sided with Perseus."

This they did by encouraging Philip on the one hand in his hostility to Rome, and provoking Demetrius on the other to stand up for his Roman friends. The result was that his father never spoke to him on Roman affairs, but trusted Perseus entirely.

"Now the Macedonians had a custom of celebrating their festivals by a sham fight, the manner of which was, after sacrifice, for the whole army to be divided into two battalions, and for the one to charge the other, representing a real conflict. And on one such occasion who should be the leaders in this pastime but the king's two sons? But believe me, they jested never more odious, he commanded his doors to be fast locked; and from the upper rooms, out of the windows, he warned off those that came to be merry with him from approaching the door.

"Demetrius after he had for a time called out against being shut out, with some noise returned again to his own house, all the while knowing nothing of what the matter really was."



AUGUSTUS.

TIBERIUS.

In its essence and in some of its details the tragedy of the Roman Emperor Augustus and his successor Tiberius bears a striking resemblance to that of Philip V of Macedon and his son Demetrius, to which Livy gives such prominence in his writings.

Photographs reproduced from Müller's "Cäsaren-Porträts" Vol. II (Marcus & Weber, Bonn.)

a whit, but went to it roundly in good earnest, as if they would determine now who should be king another day. Foul work they made with their wooden swords; many were wounded, and Perseus' battalion was completely beaten and driven off the field. . . . Each returned home with his own friends, Perseus having refused an invitation from his brother. But Perseus had sent a spy to listen what talk there was at his brother Demetrius' table. This spy demeaning himself not so circumspectly as he should, was encountered by certain youths that chanced to come forth of the parlour where they sat at supper, and was well beaten for his pains.

"Demetrius heard nothing of this, but chanced to say at table, 'Why go we not and banquet with my brother? And if there remain any anger and displeasure behind after our jousting in jest, let us appease it by frankness and mirth?' They all agreed with one voice, save only those that feared to be detected and punished for misusing the aforesaid spy. Demetrius, however, would needs have them also with him; whereupon they took weapons hidden under their apparel, for fear of the worst, that they might defend themselves, if any violence were offered. But what can be kept secret, where there is intestine discord in one family? Both houses were full of spies and false knaves. So there ran before them a tale-carrier unto Perseus, and declared unto him that there were coming with Demetrius four young men with privy daggers by their sides. And albeit Persues wist well enough what was the cause thereof, yet to aggravate the matter and make it

The next morning Perseus with some of his friends laid before the king a solemn charge against his brother of having come to his house with armed men in order to murder him. Philip sent for Demetrius and some of his own most trusted counsellors, and after rebuking both his sons for their quarrel, listened first to Perseus, and then to Demetrius' defence. The accusation is set forth in Livy's most lively and dramatic style. Perseus has no real evidence to bring, but he harps on the friendship of Demetrius with the Romans as being in itself an unfriendly thing to his father, and hints that Demetrius will proceed from murdering his brother to the deposition of his father so as to make the kingdom a Roman province.

"When Perseus had made an end of his speech, they that were present cast their eyes upon Demetrius, expecting that he would make answer immediately, and so all were silent a long time; for they perceived that Demetrius could not for weeping open his lips. But in the end they prevailed on him to speak."

Of the reply of Demetrius, a straightforward and pathetic utterance, I wish it were possible to quote more than a fraction, for the means by which Livy indicates the honesty and simplicity of the young

prince, in contrast with the crafty rhetoric of his brother, are well worth study. Demetrius begins by pointing out the prejudice raised against him by the suggestion that his interest in Rome implies disloyalty to his father; and shows his complete innocence of the charge of trying to murder his brother.

"In good faith, Perseus, if I had been a traitor to the king my father and to our country, if I had complotted with the Romans and my father's enemies, methinks you should not have waited for this night's devised fable, but you ought long ago to have accused me of treason. . . . Why, if I had minded to assail your house, and to murder you its master, would I not, think you, have foreborne for my part for one day to quaff wine, and likewise kept my soldiers from drinking so freely? But for fear I should plead my simplicity and ignorance and make my excuse thereby, this my good brother also mocks my plea in advance by declaring, 'I know nothing, I charge nobody, neither wot I what to say else, but that they came armed to banquet with me.' If I might be so bold as to ask how you came to that knowledge, you must confess that either my house was full of your spies, or that those armed men in my train bore their weapons so openly, that everyone saw them. . . . But why do you not ask whether they took their swords with them to kill you or no? And whether they did so with my knowledge? For this is it that you would make the world believe, not that which my men confess. But the case is plain that they were armed in their own defence. Whether it were well or ill done, they are of age to render a reason of their own doings. . . . Why not then make it plain, whether we meant to assail you openly or secretly? If openly, why were we not all armed? Why was there none of us besides those persons that had beaten your spy?

"This is not the first day that my brother hath accused me; but this is the first day that he hath accused me openly. . . . What hope should I have, if I had not my father for my judge? At whose hands (albeit I am not so well beloved as mine elder brother is), yet . . . I ought at least to find compassion. For I beseech you, father, to save me, for my own sake and for yours. . . . What will he do against me, think you, after you have made over the crown to him, when now already he thinks it meet to dispose of my life at his pleasure?"

The King's Decision.

When the speeches were ended and the king had taken counsel with his elder courtiers, he declared that he should decide between them not by what had then been said, but by further observing their conduct.

"Hereby they all saw well enough that the accusation touching the preceding night was sufficiently refuted; and that the only thing in Demetrius to be suspected was the great favour that the Romans bare toward him."

Perseus had no doubt expected this result, and was by no means discouraged, but continued his intrigues with Philip's courtiers, being all the while admitted to his father's counsels, from which Demetrius was excluded. After a difficult expedition, half mountaineering and half political, in which Philip undertook to climb one of the central peaks of the Balkans, Demetrius, who had accompanied him part of the journey, was sent away, escorted by a general named Didas (then governor of Paeonia), who was in league with Perseus.

"This Didas abused the simplicity of the young prince. By flattering him, and seeming to be grieved at the hard usage which the prince suffered, he laid snares for him; and in the end by his pretended sympathy, fetched out of him his purpose to fly to Rome, and offered to help him. This . . . was immediately disclosed to his brother Perseus, and by him to his father. . . .

"In the anguish of these cares, when the king had continued some months, in the end those ambassadors came home from Rome, who, before ever they set foot out of Macedonia, had devised beforehand what report they would make from Rome. To make up the full measure of their wickedness, they delivered unto the king's hand a forged letter, sealed with a counterfeit seal of T. Quinctius Flamininus, to this effect, that Quinctius said, that albeit young Demetrius had slipped a little in his inordinate desire to be king, and had written to him about some such matter, yet would he, Quinctius, do nothing to injure King Philip. . . . This forged letter struck it dead sure, and made the king believe that all the former imputations fastened on Demetrius were now proved past all doubt. . . .

"Howbeit there was no grievous sentence pronounced openly against him, to the end that rather by some covert practice he might come to his death; and this not for any fear that Philip had of the young prince, but lest any open punishment, executed upon him, might reveal Philip's secret design of making war upon the Romans. . . .

"Now it is reported that . . . the king gave Didas charge to kill his son Demetrius. . . . Didas then invited Demetrius to the celebration of a solemn festival, whereupon he came to Heraclea. And (as men say) at this supper he met with a cup of poison. He had no sooner drunk it, but immediately he felt that he was sped; for within a short while it began to work, and for very pain he was forced to retire into his chamber; where he piteously complained of the cruelty of his father, of the murderous mind of his brother, and of the villainy of Didas; and all this while endured deadly torment.

"But afterwards there were sent into the chamber one Thyrsis, a Stuberaean, and Alexander of Berea, who enwrapped his head and throat with the bedclothes and tapestry and held them so hard that they stopped his breath. Thus was this innocent prince piteously made away."

But, as the historian observes, "truth is wont to give many signs and tokens of herself"; and in 179 B.C., two years afterwards, Philip, thanks to his brave and faithful counsellor Antigonus, learnt the innocence of Demetrius and the guilt of his elder brother.

"And in this wise he spake to Antigonus:

'Since my unhappy fortune is such, Oh Antigonus, that I ought to wish myself childless, I purpose to make over unto you my kingdom. . . . No man I have but you, whom I can esteem worthy to wear the crown; and if I knew of none at all, yet had I rather that both it and the realm perished and were extinct for ever, than Perseus should enjoy it as the guerdon of his devilish act. . . . I shall imagine yet that my Demetrius is risen from death to life, if I may leave you in his place, you, the only man of all, that wept for the death of that innocent lad and for my fatal delusion, . . .'

" Soon after this, Philip was taken with a grievous malady. Howbeit it was very apparent, that he was more sick in mind than body, and that the remembrance and apparition of his innocent son, whom he had caused to be done to death, haunted him so continually with remorse that he was out of all sleep ; yea, it drove him into raving, with cursing and execrating Perseus his other son ; and so he ended his days."

Such is the story, sombre enough to compare with a Greek tragedy like that of Oedipus or Medea, as the Greek historian Polybius, writing forty years after the events, himself observed.

Modern Significance of the Story.

" But what does it profit us," perhaps the reader will ask, " to consider it now ? " Well, that depends on what we expect to see happen in the present generation —whether we think that despotism will emerge as a permanent form of government in Europe. But put the question in another shape : What motives induced Livy to give the story so much room ? In particular, why did he depict at such length (ten pages) the trial scene before Philip, the longest display of oratory that appears in the thirty-five books that have come down to us ? He gives only five pages for the speech of Camillus* against the proposed desertion of Rome, and only three and a half apiece to Valerius and Cato† speaking for and against women's rights.

Now everyone knows that the difference in length is not due to any similar difference in the records which Livy had before him, for no such records existed. The speeches which ancient historians were expected to compose are like the leading articles of a modern daily paper ; they draw out the points of a situation elsewhere described, and give us the writer's considered judgment of what that situation was. These speeches serve the same purpose as the paragraphs in which a modern historian will set himself to demonstrate the importance of some event which he has just narrated. If the modern method is better than the ancient, it is only because where the historian is wrong, as he often is, it is easier for his readers to see and correct his mistaken judgments when he pronounces them in his own name than when he embodies them in a dramatic scene.

This interpretation of past events is a point at which the function of the historian comes close to that of the poet. In one of the examples just mentioned, we know now that Livy's motive for dwelling so long on the protest of Camillus against the desertion of Rome was a real danger of the transference of the seat of government to the Hellespont, which threatened the city at the time when he was writing the Fifth Book (somewhere between 31 and 29 B.C.) ; and the same danger, as we know, called forth a poetic oration put into the mouth of Juno in the Third Ode of Horace's Third Book, and also a briefer but better placed appeal put into the mouth of the same goddess by Vergil near the end of the Æneid, at the crisis of the story. We must not stay to inquire whether any social or political motives attracted Livy to emphasize in this way the controversy about the privileges of women in 195 B.C., beyond the chivalrous and enlightened interest in women's life which is a marked feature of all his writings—though the question may be worth putting ; our business now is to discover, if we can, what reasons suggested to Livy to give prominence to this story of Demetrius and Philip. The scenes must have possessed some special significance in his mind, especially if we remember that they lay outside the straight path of his work as a historian of Rome.

Of course, we may answer that the scene was one of peculiar pathos. No doubt ; but not more so than other scenes which he depicts with lively and delicate feeling, but in much shorter space : such, for example, as the story of Verginia's death at her father's hand to save her from Appius Claudius ; the whole of this takes less than five pages.

Tragedy of Despotism.

We must look for an answer in the circumstances of Livy's day. The tragedy of Demetrius is typical of what has happened more than once when a despot has wished to establish a dynasty in his family, or has been in doubt about a successor. In such cases, directly the despot is established there begins, it would seem, almost at once, the question of the succession : who may hope to be chosen ? Remember the tragic history of the house of Tiberius which happened not long after Livy's death—for Livy survived Augustus by only three years. Tiberius' son Drusus was poisoned (A.D. 23) through the machinations of Tiberius' trusted counsellor Sejanus ; and Tiberius was persuaded by the same traitor to imprison and ultimately to destroy his nephew's (Germanicus') son (the younger Drusus) and his nephew's wife Agrippina (who committed suicide in exile), only to discover first the treachery of Sejanus and then, after his death, the whole truth. Both in its essence and in some of its details the tragedy bears a striking resemblance to that which we have just seen at the court of Macedon.

But was the stifling quality of the atmosphere at court felt in Rome for the first time at the accession of Tiberius ?

* Book V, cc. 51-54.

† Book XXXIV, cc. 1-7.

Think of the different plans which Augustus made for the succession. All but the last of them had one and the same purpose—to keep the Empire from his gloomy stepson who, nevertheless, lived to succeed him.

Augustus' Succession Plans.

First, his nephew Marcellus, a youth of eighteen, who was married to Julia, a girl of fourteen, in 25 B.C. Next, his great general and admiral Agrippa, to whom Augustus in his own grave illness in 23 B.C. handed his signet ring; but on his recovery, Agrippa was sent away to the East and Marcellus again treated as the heir; but Marcellus survived his choice only a few months. Fourthly, Agrippa again, now (22 B.C.) compelled (in order to marry Julia, the Emperor's daughter and widow of Marcellus) to divorce his second wife (Marcella, sister of Marcellus) whom years before he had married at the Emperor's command at the expense of divorcing his first! Fifthly, when grandsons of Augustus were born from this union—Gaius and Lucius Caesar, Augustus adopted them. Then when Agrippa died in 12 B.C., since they were still young children, Augustus insisted on marrying Julia, for the second time a widow, though only twenty-seven years old, to his stepson Tiberius, so that Tiberius might be the legal guardian of the two young Caesars. For this purpose Tiberius was forced to divorce his wife Vipsania, the daughter of Agrippa by his first wife, and had thus to put away Agrippa's daughter in order to marry her stepmother, Agrippa's widow! Tiberius went to Rhodes in 6 B.C., and Julia was banished in 2 B.C. But the hopes of Augustus were to be again defeated by the deaths of his two grandsons in A.D. 2 and A.D. 4 respectively. Their younger brother Agrippa Postumus, born after his father's death, would have been a possible heir but for (what we are told was) his froward disposition. In A.D. 4 (sixthly) Augustus adopted Tiberius (who had returned from Rhodes in A.D. 2); but simultaneously with him, this young Agrippa (then sixteen years old). He also required Tiberius to adopt Germanicus, the son of Tiberius' brother Drusus; for Augustus had been warmly attached to Drusus, his younger stepson.

But in A.D. 7 Agrippa Postumus, then nineteen, was banished, in consequence of a letter shown to Augustus which was written by a man called Novatus, reproaching Augustus for having accepted the fortune of Agrippa's father and given Agrippa no share. A year or two after, a plot was formed to set free the prince and his mother Julia from imprisonment and exile in order to present them to the legions and so to supersede Augustus. The plot was detected, and Agrippa and Julia remained in banishment. In spite of all this, in A.D. 13 Augustus himself, at the age of seventy-six, made a voyage to the little island of Planasia, halfway to Corsica, in order to see his exiled grandson; and had not his own death followed in the next year there seems little doubt that Agrippa would have been restored to Rome and the hopes of Tiberius would again have been put in jeopardy. How serious the risk had been Tiberius showed on his accession by putting Agrippa to death; so that the visit of his grandfather had served only to mark him out for destruction.

Now, can we suppose that while these things were going on men breathed much more freely in the Court of Augustus than they had done in the court of Philip? And knowing as we do that Livy* enjoyed the friendship of Augustus himself, is it possible to doubt that the plot of Perseus against his young half-brother Demetrius must have seemed to Livy to present a lively analogue to miseries which he knew nearer home? And with this gradual realization of what the imperial government meant, may we not connect the change of tone that readers of the Fourth Decade may observe if they remember the buoyant hopefulness which pervades every Book of the Third? In the Fourth Decade for the first time Livy betrays tokens of a certain weariness of his task.†

There is a striking parallel in the work of Livy's contemporary and fellow-Venetian, Vergil. From the happiness and hopefulness of the greater part of the Georgics, especially marked in the conclusion of Book II, the opening of Book III and the whole of Book IV (so far as its original design is preserved, that is, in what relates to Bees) we pass to the grave tone of the Æneid with death as the subject of its greatest Book, the death of the Emperor's heir as the climax of that Book, and the death of Turnus (that is to say, of Antony and his like) as the end of the whole poem. And if we ask what event brought home to Vergil how deep a shadow dogged the great imperial hope, the answer is clear: it was the tragedy of his friend Gallus in 26 B.C., who, having by his boastfulness offended the Emperor, felt himself doomed to seek death. That tragedy blotted out the end of what was probably the most perfect poem that Vergil ever wrote—the Fourth Book of the Georgics; and we can hardly doubt that that tragedy, and others like it, drove deep into Livy's mind a consciousness of what despotism really involved.

(*Concluded on page* 388.)

* See, e.g., Book IV, 20.

† See XXXI, c. 1; XXXIII, c. 20; XXXV, c. 40.

Researches on the Flight Factor in Birds.

By C. J. Patten, M.A., M.D., Sc.D.
Professor of Anatomy, Sheffield University.

In a further article in his series on the habits of birds, Professor Patten shows in discussing the flight factor how certain aspects of this wonderful mechanism have still to be investigated in detail. The theme is illustrated with photographs taken from life by the author.

WATCH a herring-gull, on outspread motionless pinions, sail into the teeth of the tempest and then float onward in calm but progressive flight :

" White bird of the tempest. Oh ! beautiful thing—
With the bosom of snow and the motionless wing ;
Now silently poised o'er the war of the main,
Like the spirit of charity brooding o'er pain."

Watch one of our dainty little warblers on migration flitting along post-haste over the sea :

" Why homeward turn thy joyous wing ?
In a far-off land I hear the voice of spring,
I found myself that moment on the way
My wings, my wings, they had not power to stay."

Watch a company of wild swans as they rise from the lake and appear slowly and with difficulty to get under way ; list to the swishing of their lumbering wings ; we are almost reminded of the cracking of many whips. But now watch these ponderous birds when well under way, controlling the air in flight superb.

" Lo ! the wild swans through the firmament swoop
With their gong-throated queen, a beautiful troop :
Wheeling gracefully earthwards, and floating as though
The young winds were wooing fair cloudlets of snow ! "

Avian flight may surely be called the poetry of motion. It has excited wonder and admiration from remote ages, and for centuries man has taxed the ingenuity of his brain in his endeavours to find out the secret by which the air may be conquered.

It is familiar now to most of us that modern aeronautics have been modelled largely according to the mechanism of the flight of birds ; and there is no doubt whatsoever that the study of the movements of these beautiful creatures, as they traverse the air, has proved of supreme practical importance to mankind. The conquest of the air, now accomplished by man, has been a momentous event ; the speed at which he can travel, and the marvellous feats which he can perform in this thin invisible medium are startling. Nevertheless a great gulf, which seems incapable of being bridged over, exists between the flight factor in man and in birds. It is this :—Human aviation depends upon two entities : one, animate, the aviator ; the other inanimate, the aeroplane. True, man and machine may be finely attuned and highly responsive, and co-ordination may be linked together in the closest possible manner, still it is ever to be remembered that the link which binds the two may possibly become severed. However, the gigantic strides which man has made in the development of

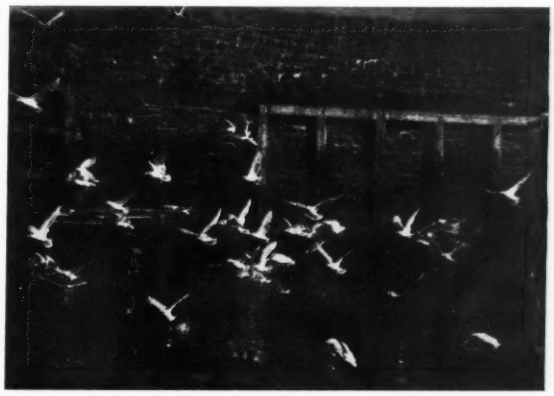


FIG. 1.
HERRING-GULLS IN RAPID FLUTTERING FLIGHT.
In contrast to the poet's picture of sailing on " motionless wing," the birds are seen clamouring and jostling each other in pursuit of the " fry " from a passing shoal.

aeronautics have already inspired much confidence. Travelling by air is rapidly becoming more general and popular ; the risk of accident will soon no doubt be reduced to a minimum ; consequently, passengers will no more be deterred from boarding an air-machine than they would an ocean-liner or the coach of a railway locomotive.

The bird in flight is one sole entity : its wings are of its body ; its quills are of its wings. Co-ordination between structure and function is completely unified. The bird cannot possibly be capsized. Its balance is such that whatever be the caprices of the air-currents, and whatever position the wings may have to assume, so surely is flight kept absolutely under control. Indeed, a bird in the air may be compared, as far as its balance is concerned, to a compass set upon a gimbal. The bird's centre of gravity is capable of being neatly and finely adjusted by various bodily movements, in which the wing-joints (and more especially the shoulder-joints with their remarkable latitude of

*

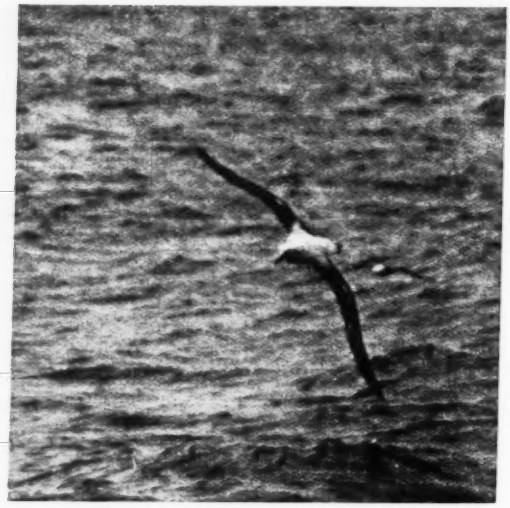


FIG. 2.
THE WANDERING ALBATROSS ON THE WING.
This leviathan petrel, weighing upwards of 20 lb., and having a wing expanse of 11 to 14 feet, planes above the sea for miles at a stretch. Weight is not only essential but is an enormous asset in flight mechanism.

movements) play an important part. The architecture of the bird's body is admirably adapted for promoting stability in flight. The body in flight might be compared to a boat moving through the water, provided with a well-formed and deep keel. In the hold of the boat—*viz.*, against the concave upper surface of the breast-bone—are lodged the heavy organs, while the keel itself is weighted with the enormous pectoral or breast muscles. Such adequate ballast enhances stability. The wings and the very light organs, such as the lungs and air-sacs, are situated on the dorsal or upper aspect of the body—that is to say, on the deck of the boat. Thus the centre of gravity falls as low down as possible under the suspension of the wings. A bird can alter its centre of gravity in many directions. Here are a few methods most obvious to observers:—Backward or forward movements of the fully-expanded wings; fanning and rotation of the tail; coiling and stretching the neck; flexing one wing and rotating the head. The last two adjustments are usually called into play when the bird, by *banking* or, as it is also called, *canting* its whole body, turns and steers a new course.

It is most important to note that all birds are heavier than air, and that weight is not only essential but is positively an enormous asset in the mechanism of flight (Fig. 2). Without proportionate weight the necessary momentum gathered as the bird proceeds under way would not be sustained. An aerial creature lighter than air would pass into space uncontrolled like a helpless, hapless balloon. In days gone by, when the movements of a balloon were looked upon as an object-lesson in regard to flight, it was thought that the heated air, which in birds filled their sacs and pneumatic bones, reduced the density of the body so appreciably that it rose *ipso facto* like a balloon. Apart from the disadvantage which loss of weight would entail in the mechanism of flight, it is to be observed that a bird can accommodate only an insignificant amount of air in its sacs over and above what is necessary for pulmonary purposes. For it must be borne in mind that the lung of a bird is relatively small and inelastic, and that the sacs are primarily to be regarded as pulmonary extensions which make up for the deficit. It is true that the sacs extend into bone-chambers, between muscles, and into other recesses, but allowing for all this pneumaticity of a bird's body, diminution in its specific gravity may be regarded as negligible. Furthermore, large numbers of swift and powerfully flying species possess solid bones. "If by any means a bird attained the lightness of a balloon, he could not fly. A balloon drifts with every gust; steering is impossible; the wind chooses its course. A machine which is as light as air can have no strength to gain a velocity other than that of the air-current in which it moves. The bird-balloon, as light as the wind and as strong as iron, is a figment of the imagination" (Headley). When man appreciated the fact that, bulk for bulk, a goose, a gannet, and

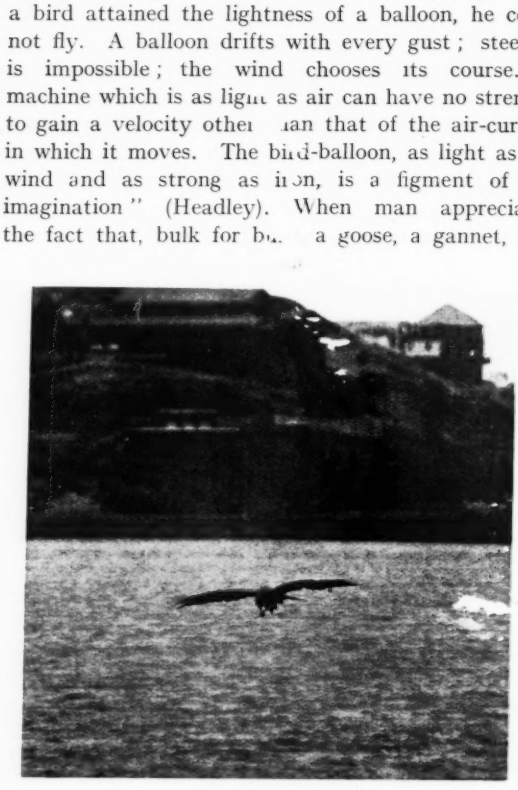


FIG. 3.
KITE DINING IN MID-AIR.
Suspending itself in mid-air, the bird is seen devouring a piece of meat thrown overboard from a vessel. A bird, when hovering over one spot, must flap its wings with great rapidity; hovering and the initial stage of onward flight are alike in mechanism.

several other kinds of birds were as heavy proportionately as many terrestrial mammals, he discovered that he was on the right track in designing a flying-machine which would move through a medium much lighter than itself.

The flight factor in birds ranges widely according to the form of the wings, their ratio in size and strength to that of the body, and also in a great measure according to the conditions of habit and environment. It is in the long-winged and more buoyant types of birds, which spend so much of their time on the wing, that one beholds the most exquisitely graceful aerial gyrations and evolutions, featuring flight in all its glory (Fig. 4). Undoubtedly birds take a keen delight in their flight manœuvres during their intervals of leisure, just as an accomplished dancer or skater would take delight in practising his favourite pastime. The graces of flight inspired John Ruskin to symbolize the bird as: "little more than a drift of the air brought into form by plumes, the air is in all its quills, it breathes through its whole frame and flesh, and glows with air in its flying like blown flames, it rests upon the air, subdues it, surpasses it, outrac[illegible] it, *is* the air, conscious of [illegible], conquering itself, ruling itself."

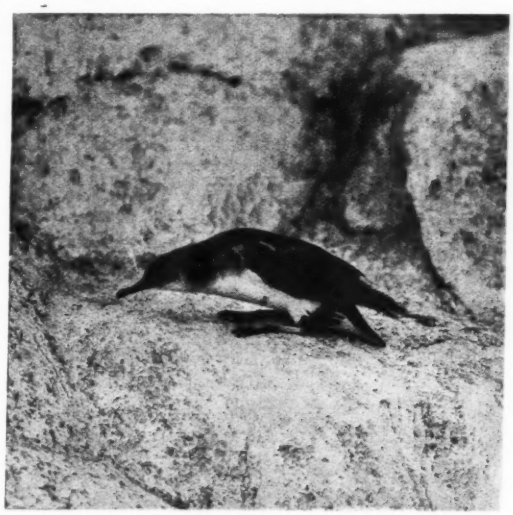


FIG. 4.
MANX SHEARWATER LOCOMOTING ON LAND.
After being captured by hand and liberated on the ground, this bird creeps slowly along with outstretched neck and lowered head. The flight, however, is amazingly graceful, the bird "shearing" over the billows.

Technically speaking, flight is but a special form of animal locomotion. It differs only in degree, not in kind, from walking and swimming. The mechanics of animal locomotion in general are essentially similar. The track produced, as the animal moves through its respective medium, is always in the form of curves. This arises from a reciprocal action, in which the trunk moves on the limbs and the limbs on the trunk alternately. The "ball and socket" formation, typical of the shoulder and hip-joints, permits of a rotatory and reciprocal action. In this way movement becomes co-ordinated and essentially rhythmic. Furthermore, when an animal gets fairly under way, it is helped along to a considerable extent by its cumulative momentum, and for that reason expenditure of energy is to a large extent economized. This, as we shall see presently, is a most important matter in connexion with long-distance flights. If animal locomotion were devoid of rhythm, it would be jerky, intermittent and full of dead points; indeed, it would be laborious and consequently far from being efficient. In short, all animal locomotion is framed on one general principle—namely, a rotatory, reciprocal, and rhythmic action, in which the movements of the trunk upon the limbs and the limbs upon the trunk are absolutely interdependent. The efficiency of reciprocal action is clearly seen in the way the body of a moving animal is levered onwards, whether it be a horse trotting, a fish swimming, or a bird flying.

In all forms of animal locomotion a fulcrum is absolutely necessary. In the case of the moving land-animal the fulcrum is represented by the solid unyielding ground, which offers maximum resistance and therefore calls for minimum or no displacement. As an adaptation the mammalian foot is relatively small. In the flying-bird the yielding and compressible air, when seized upon and encompassed by the descending wing, plays the part of a fulcrum. Here, it is obvious that the wing experiences the minimum resistance and so produces on the movable and compressible fulcrum the maximum displacement. Hence, as an adaptative measure, the wing area is of enormous dimensions. This amplification is brought about by the addition of a complex system of feathers to the fore-limb. In the lever system, which is adapted to animal locomotion, the fulcrum is at one end; the power (the muscles which work the limb) in the middle, and the weight (the body of the animal) at the other end. Here is presented what is technically known as a lever-system of the third order, and *per se*, the least efficient of lever-systems. However, as dead weight is soon replaced by rhythmic momentum, it becomes evident that the mechanics of animal locomotion are quite well adapted to serve their purpose.

In birds the disposition of the feathers affords a wonderful study.* The flight feathers can act under special circumstances as independent units, and can

* See the author's "Researches on the Plumage Factor in Birds," *Discovery*, Vol. VI, No. 70.

produce a distinct valvular action for the purpose of compressing or releasing currents of air.

The mechanism of the wing-stroke in so-called ordinary " flapping " flight is a matter of great interest, and is still imperfectly known in all its details. To the casual observer the wings appear to take a vertical up and down path. In reality the strokes are compounded of several phases involving forward and backward movements, rotation, extension, and flexion. The wing-strokes have for their main object the compression and screwing down of the air and the unscrewing and releasing of it. In powerfully-flying birds with ample wings, a mass of air on either side of the body is seized upon, encompassed, and compressed during the down-stroke, thereby elevating the body. The down-stroke is a powerful muscular action, and the pectoral muscles which bring about this movement are enormously developed, in some birds a hundred-fold greater than in the case of man. These muscles occupy the spacious area on either side of the keel of the breast-bone. During the down-stroke the wing is fully spread and acts as a long lever; during the up-stroke the wing is sharply flexed in order to release the compressed air all the more quickly and fully and so prepare the wing to sustain the momentum during the succeeding down-stroke. It is evident that were the wings held rigidly at full stretch and simply flapped up and down without rotation or other additional action, forward—*i.e.*, progressive—movement or momentum would not be effected. Flexion, or folding of the wing, is so quickly produced that it usually eludes observation; yet we see that it is an absolutely necessary phase of the flap-cycle. The up-stroke is for the most part passively performed, it being due in the main to elastic recoil. During this movement of the wing, however, the body is allowed to gravitate actively. On the other hand, the down-stroke, as we have already noted, is actively performed by muscular action, the body at the same time being passively raised. The leverage maintained by the tip of the wing (composed of very stiff resisting feathers popularly called the " quills ") acting upon the mobile compressible fulcrum—the air—coupled with the magnificent power of the great breast muscles, are highly efficient factors in the mechanism of sustaining the body-weight. The body as well as the wings move onwards in a curved trajectory, and body-weight, as before mentioned, is an all-important asset to progression through the air, rather than as was formerly thought, a hindrance. Herein lies the explanation why it is that so many very heavy birds with small and often at the same time short wings, are excellent fliers.

Flapping flight is rendered all the more efficient by induced currents, which are to the wings what a stiff breeze is to a boy's kite. A bird, when hovering over one spot must flap its wings vigorously and with great rapidity (Fig. 3). Mechanically, hovering is on a par with initial onward flight; but when the bird is once under way it creates a current of its own making on which it progresses for miles without becoming fatigued. During migration, birds always elect to fly as close as possible, *ceteris paribus*, head to wind, at a moderate velocity and altitude. Small birds in general travel at about twenty-five to thirty-five miles per hour. Swallows and swifts often double and treble that speed. On lengthened pilgrimages, birds conserve their energies on the wing as much as possible by resorting to *planing* and other adroit methods, which give temporary or intermittent rest to the muscles. The endurance of migrating birds on the wing is truly remarkable; it is only in the most adverse weather that they will stay their flight, so ardent is their desire to reach the focus of destination.

Correspondence.

" THE ORDINARY MAN AND THE POET."

To the Editor of DISCOVERY.

SIR,

The contrast, and the cause that gives rise to it, between the minds of ordinary men and poets is a subject of perennial interest, and it is refreshing to find an attempt to explain the difference in a thoughtful article published in your September number. According to the writer of the article, the disparity is not so great as people imagine it to be, if we limit the comparison to lyric poets. He suggests (if I understand him aright) that most of us possess when we are young a poetic sense derived from self-love, and that as we grow older we gradually lose touch with it. The lyric poet, on the other hand, retains in his maturity the self-love of childhood, and he uses it as a kind of standard for appraising and giving expression to the heartache and unfulfilled desires of his fellow creatures. The affinity is unbroken, but the lyric poet's agency is required to attune the chord and give it vibration. Wordsworth has something to the same effect in one of the introspective passages of the Prelude (Book II, 233-265), which concludes with the following lines:—

> Such, verily, is the first
> Poetic spirit of our human life,
> By uniform control of after years,
> In most, abated or suppressed; in some,
> Through every change of growth and of decay,
> Pre-eminent till death.

But there is, apparently, another affinity between the ordinary man and the poet, which was pointed out recently by

Mr. Middleton Murry—an affinity manifested by the peculiar influence of poetic metaphor. Mr. Murry, in analysing the power of metaphor, says :—" The secret surely is that this likening of one order of things to another, which is almost an identification of one order with another, is the discovery of a harmony in the universe. If it were not so, we should never feel that metaphors were true, and I think that we should never feel that they were beautiful. But this incessant revelation of a harmony immanent in the world thrills us and brings us peace."

These two affinities, perhaps, account in some measure for the comfort that mankind has derived throughout the ages from the Hebrew lyrics of the Old Testament—lyrics that are full of metaphor and self-pity.

Yours faithfully,

London. *6th October*, 1926. F. R. BARTON.

" THE STRUCTURE OF THE ATOM."

To the Editor of DISCOVERY.

SIR,

My answer to Dr. A. S. Russell's objection that hydrogen has never been found as a product of the disintegration of atoms expelling gamma rays is that the probability is that they are all absorbed by the atoms on which they fall. We know that many of the X-rays—of much less penetrative power—are thus absorbed. As to the loss in weight in radio-activity being more in my case than it is with the orthodox atom, this evidence is not against me. It is pure assumption that four in weight is lost when an alpha ray leaves the atom, since the alpha ray is not a helium atom when it leaves the atom. According to the orthodox view it gains two electrons after it has left the atom, and thereby becomes a neutral atom of helium instead of a double-positive alpha particle. My hydrogen atom weighs three when it leaves the atom (H_3). The latter is supposed to be triatomic hydrogen, but there is no proof of this. We only know that it is of mass three. On losing the outermost electron it will become the negative atom with two electrons that we know so well, and when one of these electrons is lost it will become the neutral atom with one electron. When the atom is bombarded, however, all three electrons may well be shot away, thus leaving us with Sir Ernest Rutherford's positive hydrogen atom or proton.

Yours faithfully,

FLORENCE LANGWORTHY.

The Fuchsias, Claygate, Surrey.
15th October, 1926.

" THE GROMA."

To the Editor of DISCOVERY.

SIR,

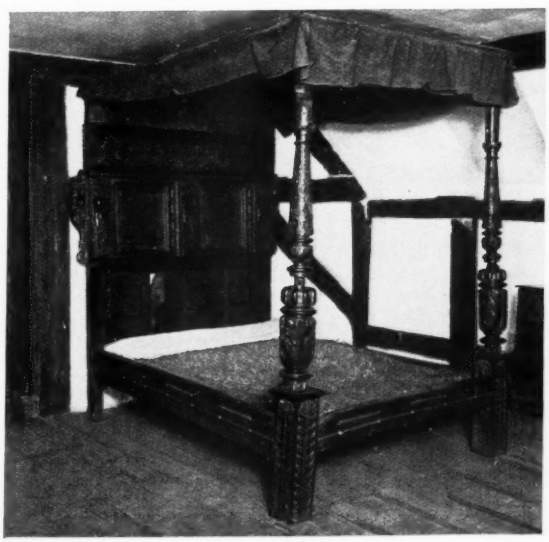
I was much interested at seeing in your September issue that another " groma " had been brought to light. I always think that the methods used by the ancients in engineering construction are even more interesting than the remains of works constructed by them. The reason why their instruments are so rare is that the parts made of wood perish, and the parts of metal become detached, lost, and unrecognized.

It would be very interesting if the other ancient surveying instrument, the " dioptra," should ever be discovered ; it was superior to the groma according to Hero of Alexandria. How far it was actually used for setting out lines at right angles it is difficult to say, but it certainly appears to be the only instrument for long-distance levelling comparable to the modern engineers' level.

Yours faithfully,

68 Victoria Street, S.W. R. C. S. WALTERS.

A Relic of Shakespeare ?



SCENE OF THE DISCOVERY IN ANNE HATHAWAY'S COTTAGE.

THE INITIALS CARVED ON THE NEWLY-FOUND BOOK MOUNT.

DURING recent restoration in Anne Hathaway's Cottage at Stratford-on-Avon, the wooden mount of an old horn-book was discovered in the room containing the Elizabethan bedstead of the Hathaway family. The mount, seen above, is carved with " W. S." or " W. B.," and was found under the floor-boards to the left of the bed-post in the foreground of the adjoining photograph. The discovery is discussed in this month's editorial notes.

Discovering American University Life.

A British Undergraduate's Impressions.

Every autumn increasing numbers of British students are sailing for the States, but since scholarship arrangements have existed only within the past few years, as yet little is generally known of university life across the water. Next month an American undergraduate resident at Cambridge will contribute impressions from another angle.

"It is to only a small minority that the opportunity of travelling abroad is given and, when the name of a country we have never visited is mentioned, we almost instinctively think of the one or two representatives of that country that we have met, and judge the whole nation by them. . . . The only satisfactory way of really understanding what conditions are like in any given country is to go there and mix with the people."

THUS wrote* the captain of the Cambridge Relay Team that spent a fortnight in America in the spring of 1924: but although the opportunities which international athletic contests afford are fortunately increasing and there are several scholarship foundations to enable British students to visit American universities, the number of those who do so is as yet comparatively small. There is still an element of discovery in a voyage across the Atlantic, and the American's impression that every Englishman who visits his country writes a book about it, though a sarcastic one, is not very far from the truth.

Any attempt to generalize about the educational system of the United States on a basis of a year's residence at a single university is bound to be limited in value—more especially in the case of a country which can boast of six hundred universities spread over an area about equivalent to that of the continent of Europe. There are none the less many institutions that are common to the American system as a whole, and the conclusions deduced from the following impressions may perhaps be regarded as representative at least of the larger universities in the Eastern States.

A year's residence in America was indeed an experience of discovery, to such an extent is the setting and tradition of its university life unique to the New World. Not that the American, particularly the undergraduate, differs essentially from his British counterpart, as the least acquaintance will show, though the systems of the two countries naturally engender their particular points of view. The difficulty, in fact, of forming a distinctive impression of one's hosts at the time, as a solitary Englishman and in the absence of a fellow countryman with whom views can be exchanged, is tremendous. Generally speaking, even the consciousness of accent, so often assumed to be a determining factor—with the exception perhaps of the short "a" characteristic of the American speech—disappears completely after a few months' acquaintance.

Towards the end of the war, when I was still at school and America had just joined the Allies, I heard Mr. Walter Hines Page give an address* which I remember chiefly because of the circumstances attaching to it.

"There are certain things," said the American Ambassador, "which on your visits to the United States—and I think you will not do your duty or complete your education until you do visit us—you will discover about your kinsmen there: one is the universality of education. In many of the States education is compulsory. Every State may have and has what sort of education it likes. Some have better systems than others; but they all maintain it at the public expense. In Wisconsin they are providing now at the State University for twenty thousand students from that one commonwealth."

I cannot claim that Mr. Page's words had any connexion with my visit to America, but when some years later I found myself an ordinary Freshman at Princeton University, the extent of the machinery for education in America was among my earliest observations.

The Public Schools.

The "public schools" there (and they are so termed) are the State secondary schools, to which anyone may go until sixteen and even eighteen years of age with a view to a university education; and if in Great Britain it is the exception for those with more than a certain means to send their children to the state-provided schools, in America this condition of affairs is almost reversed. It is really uncommon for a well-to-do parent to send his boy *away* to school at least until he is fourteen, and after that age it is not even usual; he goes as a matter of course to the local public school. This widespread opportunity for learning is reflected in the organization of the universities. In the first place, the demand for admission is enormous and has considerably raised the standard of the more important institutions. Secondly, four (instead of three) years' residence is required, a probable outcome of the absence of the background traditionally associated

* "A Fortnight in America with the Cambridge Relay Team." W. S. B. *The Caian*. Vol. 32, No. 3, p. 96.

* "The American Ambassador." *The Harrovian*, February, 1918, p. 36.

with the boarding school—in America the possession of comparatively few of those attending the university. As an American professor who exchanged his Chair

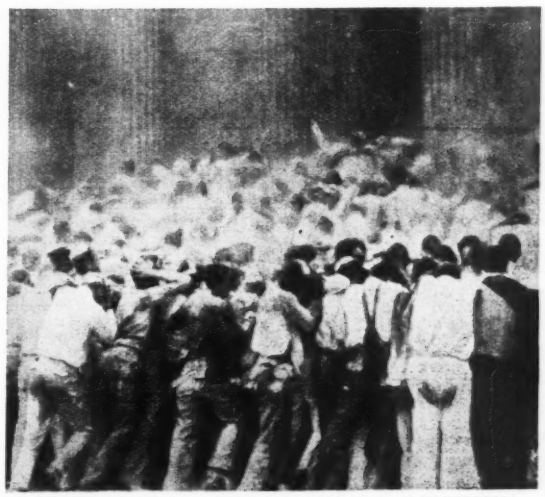
AMERICAN UNDERGRADUATE WEARING HIS CLASS NUMERALS.*
These insignia take the place of the college crest on the English blazer, students being classified according to the year in which they will be graduated.

for a year with an English colleague recently wrote:† "English students appear to be a bit more mature and to have a more solid preparatory education. They are capable of better independent work earlier in their college course." Yet how many more enjoy higher education in the United States can be judged from the fact that the percentage of the population attending the universities is there about three times as large as in Great Britain. The standards of admission naturally vary considerably, but the requirements of some of the Eastern universities, such as Princeton, are every bit as exacting as those of Cambridge and elsewhere, not excepting London University, this being written after matriculation at each of these three universities.

The outstanding distinction in organization that first strikes the English visitor is the absence of colleges at the American university. These are replaced by division of the undergraduate body according to year, so that the freshmen are one "class," the second year men another, and so on—the word class denoting unit and having none of its ordinary significance. Each class is named by the year in which it will be graduated, and since four years' work is required for a degree, a student who was a freshman in 1922, and will have taken his degree this summer, is a member of the "Class of 1926." "Smith of King's" at Cambridge is simply "Smith '26" across the water, and the class in America takes the place of the college in England. The "numerals" worn by American students, sometimes a puzzle to the visitor, though gained only by certain athletic distinction are simply the equivalent of the college crest that adorns the English blazer. The American Alumnus thinks of his old university in terms of "'99" or whatever the year in which he took his degree, but while this constitutes an especial bond between members of any particular class, and gives an additional significance to the friendships connected with it, the university buildings as a whole can hardly have the associations of one's college in England, with its hall and its courts and its gardens.

The organization of studies, board, and lodging is central, and one treasurer manages the finances of the whole university, this central administration requiring a comparatively small staff. While in the English system of each college having its dean and bursars there is a certain amount of overlapping, this is compensated for by the large number of "dons" that it enables to be connected officially with this or that college, not only thereby to earn an income, but by their residence to render the individual tutorial system more complete. Several of the principal American universities are gradually introducing preceptors, but despite their generous endowments are to some extent handicapped for want of such positions as can supplement the fees the university can afford to pay those whose sole capacity is that of supervisor. For this reason there is probably some doubt whether the tutorial system will ever be as complete in America as it is at our older universities.

Owing to the absence of the centre of activity that the college in England provides for the entering



FRESHMAN "FLOUR PICTURE" IN PROGRESS AT PRINCETON.
In order to inculcate a sense of unity among the first-year men, they are submitted to ragging by their seniors which at Princeton culminates in a mass bombardment with flour and water.

* Sketches reproduced from Coco-Cola Co. advertisements.

† "An American 'Exchange' Professor's Year in London." By L. W. Boardman. *The Landmark*, September, 1926, p. 588.

undergraduate, the creation of a " class-consciousness " —using the phrase in its purely American academic significance !—is necessary early in the career of the undergraduate across the water. I am here going to

"CHEER LEADER" IN ACTION AT A BASEBALL GAME.
He stands at the edge of the field of play, facing the stands of spectators, whom he exhorts with gestures of the arm to cheer in unison.

quote from an article I wrote* shortly after my return, when the early events of a memorable year were perhaps more vividly in mind.

" The hazing, or ragging, of freshmen is a regular practice in America, and is designed to give the entering class something in common at the start which will create a sense of unity. It is tradition that a freshman's life is not worth living, and second-year men see to it that this idea is kept alive ; though every class says that things are not as they were in their day, that freshmen get it lighter each year, and so forth. Our fathers always did have a thin time ! In order that he may know the members of his class—and that seniors can spot him, too—the freshman at Princeton has to wear a black skull-cap, black socks, and quiet clothes. ' Hat on, freshman,' is shouted as soon as the official opening ceremony of the year is over, and thereafter you are a marked man. You must give way on the pavement to your betters, and may not walk on the grass ! In the 'eighties it was customary to haze the freshman individually—he was tossed in a blanket or ducked in the pond—but this is now substituted by mass hazing. Garter and sock inspection is one of the first jokes which you have to face. ' Roll up your trousers and run—beat it ! ' greeted us one day as we streamed out of the dining-halls after lunch, and across the court we were rushed by fours, free from harm if the socks were of the right colour !

" The chief event of freshman initiation, however, was the ' Flour Picture.' This was announced to take place one Monday afternoon at the beginning of term, and we were warned to wear old clothes. Following a meeting of the class, we marched in procession to the place announced. As we got near, the bombardment by our seniors started, and we rushed on to the steps of the building where the photograph was to be taken. Flour and water formed the bulk of the ammunition, but eggs, and treacle as well, helped to liven things up ! Meanwhile, a fearful scrum took place round the steps, and we all fought to get nearer the back to escape the first line of fire. A hose directed on us from the roof above added to the excitement. Since flour and water are the principal ingredients of paste, we were in a dreadful mess after twenty minutes' bombardment, when we were then formed into a group and photographed. The ' Flour Picture ' is one of my cherished possessions ; but my regret is that I did not return for a second year at Princeton, and so missed my chance to help in the initiation of the succeeding class. It took some time to remove all traces of the afternoon, and my clothes were only fit for the dustbin."

* " Columbus Undergraduate : An Englishman's Experiences at Princeton." *The Tatler*, December 3, 1924, p. 467.

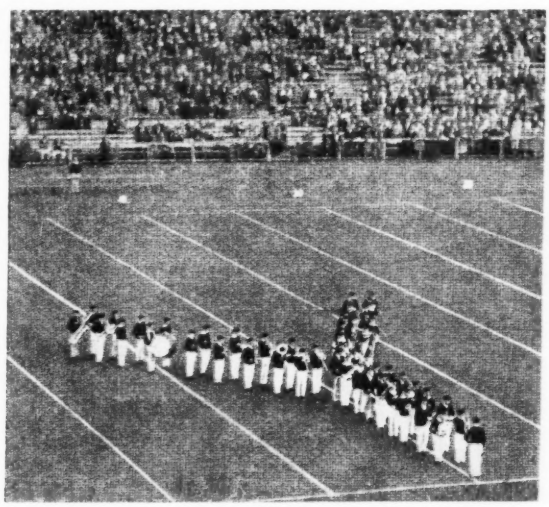
Athletic Organization.

Because the undergraduate body is divided only by seniority, the word " college " has none of the significance attaching to it on this side of the Atlantic, and is used synonymously with " university." An inter-collegiate football match is played between Princeton and Chicago, or between Harvard and Yale, and the final between, for instance, Caius and Trinity at Cambridge, has no counterpart whatever in America. That is to say, a most obvious consequence of the absence of colleges is that the scope of competitive sport within the university is very much reduced, and the number that can take an active part in any and every sport is necessarily limited. The remarkable fact is that American teams compare so very favourably with their English opponents in the various international contests, which are fortunately now becoming annual events.

I cannot leave this aspect of student life without a passing reference to American football. If in itself it is somewhat tedious to watch, owing to the numberless pauses that result from the elaborate formation taken up by the teams between each decisive point in the play, the crowd and the customs associated with a Game has a peculiar fascination for the visitor—in America they do not speak of matches and a game, as we know it, is merely a " work-out." " Over 50,000 people came to watch the game between Yale and Princeton "—to quote again from my earlier article—" which was played in the university stadium. Wembley was not built when I went to America, and I have only since seen the Coloseum at

Rome—so that I shall never forget the impression the stadium made on me when I first saw it filled with such an immense crowd. Organized cheering is carried on during the match, and this takes the form of rhythmic sentences which are shouted to time, a ' leader ' facing the crowd and going through a series of movements with his arms. ' Hooray, 'ray ! 'ray ! tiger, sis, boom, ah ! Princeton ! Princeton ! Princeton ! ' is the chief cheer of this university, the tiger being its mascot."

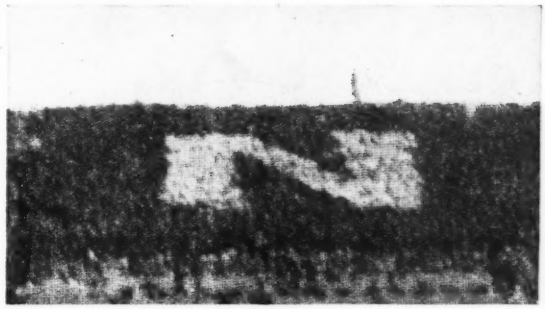
In addition to showing its enthusiasm by cheering, a particular side may organize a display among its supporters in a special group of reserved seats known as the cheering section. Usually following a cheer, the " leader " goes through an agreed signal, and among the wall of spectators—seen like a swarm of bees from the other side of the stadium—a letter will suddenly stand out in white—" P " for Princeton, " N " for Navy (by the students of Annapolis, the American Dartmouth College), or whatever university it be—caused by the pre-arranged display and waving of scarves by those in seats of a particular number. The effect of this demonstration, though the analogy does not express its unique character, can only be compared to a special formation by a military battalion at physical drill. Each side, too, has its band in attendance in the stadium, which at half-time will march on to the field, again often in formation to represent the " letter " of its particular university. When the Game is over, the supporters of the winning side rush on to the ground and dance round in



Photos by courtesy of " Daily Princetonian."

UNIVERSITY BAND PARADING IN FOOTBALL STADIUM.

At inter-university football games the bands of the opposing teams march in formation of their letter—in this case, " Y " for Yale—during the interval between play.



UNIVERSITY LETTER FORMED BY STUDENTS IN FOOTBALL CROWD.

By pre-arrangement with spectators in a special section of seats in the stadium, scarves are produced at a given signal, representing a challenge—here " N " for Navy—to opponents' supporters opposite.

procession, with an enthusiasm and excitement that is quite remarkable, cheering the losers as they go.

A factor in social organization which is characteristic of American university life—though it had its counterpart in some of the Scotch universities—is the practice of " earning one's way through college." While higher education is provided by the State for everybody alike, the number who can attend the free public universities is limited, and such is the determination to get a varsity education that many students earn part or the whole of their expenses by work of one kind or another. These jobs do not greatly interfere with the general activities of those who undertake them, while a very large number of students get employment during the summer vacation. This practice of " earning as well as learning " is very common in America, and is not confined to the lesser universities, where probably 70 per cent of the students are working in this way. Even at Princeton, where the fees are high and the number of undergraduates is strictly limited to about two thousand, perhaps 30 per cent are engaged in employment of one kind or another. At this particular university, a " Bureau of Student Self-Help " manages the work, and in general plans it in such a way that anyone may be accommodated for as long or as short a period of regular employment as he desires, an aggregate sum of many thousand dollars being annually earned by this arrangement. All the waiting at table in the university dining halls, for instance, is done by students, who can earn their entire board by serving a certain number of tables per week, and a good bonus besides for any above this minimum. They put on their white aprons and carry trays at one meal, and sit with their friends at the next ; and such is the genuine equality of outlook, largely attributable to their uniform secondary education, that those who take on such work do not suffer in social status thereby. But this student employment is not limited to the dining hall, and many

STUDENT WAITERS IN UNIVERSITY DINING HALLS.
In America the practice of "earning while learning" is quite common, and many undergraduates earn their expenses by employment of one kind or another.

other opportunities of earning are made. At football Games, when the huge crowds assemble, the students act as gatemen, score-card sellers, and so on, and during a recent season at Princeton as many as 220 undergraduates took part in this particular sphere of work, earning over £1,000 between them. Undergraduates also act as accountants in the local banks, they manage a book and newspaper agency, and are reporters to the newspapers.

An account of American university life would be incomplete without mention of the hospitality extended to the visiting English undergraduate, who is welcomed from the moment he lands in America. An essential condition, however, to the development of an exchange of students on any considerable scale is that some means be found of allowing credit for residence in one university towards a degree in another. At present the student who desires foreign experience must extend the time he would ordinarily spend on his education, and very few can afford to do this. Such recognition should be of the highest value, for the friendship formed by the students now crossing the Atlantic is a very real bond between the English-speaking peoples. J. A. B.

The Preaching of the Crusades in America.

By Lewis Spence.

Thirteenth-century records preserved in Rome have revealed that the Crusades were preached on American soil, and that early Norse settlers actually contributed Peter's Pence to the Vatican. Evidently the colony was of considerable importance, a fact which awakens interesting suppositions regarding the history of Europe's first settlement in America.

THE oft-repeated jibe that "America has no history" has never recommended itself to serious students of her antiquities, and the well-authenticated fact that the Crusades were preached on American soil by Christian priests at the end of the thirteenth century should surely have the effect of restraining scoffers. The national records of Iceland and Norway, and certain documents in the Vatican, contain irrefragable if not abundant evidence that at the period in question the Norse colony of Vinland in America was not only placed under the care of missionary propagandists, whose duty it was to preach the Crusades in that region, but that it actually subscribed its quota of Peter's Pence for the liberation of the Holy Sepulchre.

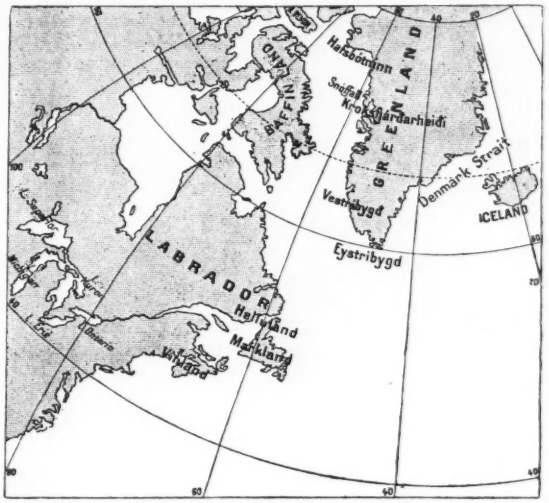
At the end of the thirteenth century Scandinavian exploration and settlement had achieved a geographical extension greater, perhaps, than that of any other European race. Scandinavian influence at that period, indeed, extended from Palestine to Massachusetts. Shortly after Scandinavia accepted the Christian faith Norse pilgrims began to journey to the Holy Land in ever-increasing numbers, and the Church, realizing the intensity of crusading zeal in the north hastened to avail itself of this overflowing source of martial energy by preaching the holy war in Norway, Iceland and Greenland, and enlisting their hardy sons under the banner of the Cross. Nor were its efforts bounded by the bishoprics of frozen Greenland, for the missionaries dispatched thither actually extended their labours to embrace that Vinland discovered in America by Herjulfson, Leif, and Karlsfne, some centuries earlier.

Abundant Evidence.

Abundant evidence exists that this isolated American colony of the Norsemen was not only well-known to the Europe of the thirteenth and fourteenth centuries, but that it was familiar to the Vatican through missionary effort and correspondence. Pope Gregory X, as Archdeacon of Liege, had accompanied the Frisian Crusaders to Palestine in 1270, and was well acquainted with the geography and seafaring conditions of the north. In 1273 he convoked at Lyons an œcumenical council, the purpose of which was to organize crusading

effort in western and northern Christendom, and to Sighorte, Canon of Trondhjem, and Arne, Bishop of Skalholt, in Iceland, he entrusted the task of propaganda throughout the Scandinavian realms. Bertrand Amaury, Canon of Rheims, was moreover dispatched as papal legate to these dominions and was instructed to extend operations to those outlying Norse colonies to which crusading endeavour had not as yet penetrated. Lapland, Finland, the Orkneys and Hebrides were embraced in the scheme, and their settlers, impressed by the necessity for liberating the Sepulchre, contributed generously according to their means. In Iceland Arne Thorlaksson preached the Cross with a fervour unsurpassed by Peter the Hermit himself, and its clergy willingly agreed to resign a tithe of their substance to the crusading war-chest, while its man-power, with equal readiness, enlisted under the banner of the Church militant.

King Hakon of Norway had dispatched Olaf, Bishop of Gardar in Iceland, to Greenland in 1261, with instructions to keep the Norse colonies both there and in America more closely in touch with the motherland. Olaf made further good use of his time while in Greenland by preaching the Crusade. For some years prior to this a republican or separatist spirit had appeared in these colonies, precisely as some centuries later it was to do in the British transatlantic settlements and, perhaps, for similar reasons. But equilibrium had been restored. In 1276 the Pope authorized the Archbishop of Trondhjem, Jon the Red, a Scot, to dispatch a commission to Greenland to assist Olaf in his crusading efforts, and to insure that the edicts of the Council of Lyons were being carried into effect. In 1279, seizing the opportunity of a vessel sailing to America, he sent "a grave and discreet person" thereon to preach the Holy War and to recover the tithes due from the colonists. The name of this American Peter the Hermit we do not know, but his commission was confirmed by Pope Nicholas III, in a letter dated from Rome, January 31, 1279, conferring on him full powers to further the crusading movement by every lawful means. Three years later this emissary returned to Norway with a cargo of sealskins, walrus-tusks, and whalebone, the offerings of the American colony of Vinland to the soldiers of the Sepulchre. Archbishop Jon, embarrassed by the strange nature of the tithe, which he could not dispatch to Italy, communicated with the Vatican as to the best method of disposing of it, and in March 1282 Pope Martin IV replied, authorizing him to sell it in the best market. This was done, and the sum realized was sent to Italy, to the banking houses of Squiarccialupi and Giudiccioni.



MAP TO ILLUSTRATE SCANDINAVIAN DISCOVERIES IN AMERICA

After the Council of Vienna in 1312, we find Arne of Gardar acting once more as agent and collector of Peter's Pence for that council in respect of the American colonies. It would seem that the zeal displayed in these far outposts of the Scandinavian world had lapsed somewhat since 1276, and that efforts were once more made to awaken it. In the interval Arne had been created Bishop of Bergen, but had been replaced in his former charge because of his well-known influence and propagandist ability among the Icelanders.

In the same year Laurence Kalfsson and Bjorn had ardently preached the Crusade in Iceland, whose hardy sons were greatly in request in the ranks of the Cross. That emissaries were once more dispatched to Vinland in America at this time is undoubted and is, indeed, proved by the results, but who they may have been, and what were their adventures, we have no means of discovering. In the event a Vinland ship arrived at Greenland in 1325, bearing the tithes of the colony, consisting of 127 lispounder of walrus tusks, which were duly sold to Jean du Pré, a Flemish merchant, for 12 livres, 50 sous of Tour.

The Only Colony.

Vinland is, indeed, the only Norse colony in America mentioned in the records of northern crusading. As is now well known, it was first discovered by the Icelander Bjorn Herjulfson in 938, and was later settled by the efforts of Thorfinn Karlsfne. It has been identified by various Americanists with Massachusetts, Rhode Island, and Prince Edward's Island, and a recent authority has even suggested

MAP OF THE SCANDINAVIAN EXPLORER STEFANSSON, 1570.

that there may have been two colonies of that name, the Vinland of Leif, lying much farther south than the Vinland of Karlsfne. This does not seem to tally, however, with a note on the map of Sigurd Stefansson (A.D. 1570), which extends the territory embraced by Vinland to an outlet in the neighbourhood of Chesapeake Bay, and the implication appears to be that the colony had a much greater scope than is generally credited. It is surprising, in view of the deep impression which the American discoveries of their countrymen made upon the Norsemen, to find so few references, with the exception of those already alluded to, between the era of the first discovery of America and the end of the fourteenth century. A fifteenth-century map of Catalan origin, preserved in the Ambrosian Library in Milan, displays a large insular locality south of Greenland, which seems to show that at that period there was a general impression of land in mass south or south-west of Greenland, and reasonably accessible therefrom.

The well-authenticated records of the payment of Peter's Pence to the Vatican by the colony of Vinland assist the conclusion that it must have existed as a loose dependency of the Norse Crown until 1325 at least. What conditions actually prevailed there, what were the number of its colonists, and what hold they had gained on the country other than a coastal one, we do not know. We can only infer from the fact that as Vinland was regarded as being of sufficient importance to be the object of a special crusading mission, it must have boasted at least several thousands of a population and a central settlement.

No room, then, is left for doubt that the Crusades were actually preached on American soil, and that tithes to assist the pursuance of the Holy War were collected in the western continent. Although the evidence is scanty, it is sufficient for credence, and further research in the Icelandic records in the Vatican may yet greatly enlarge our knowledge of early communication between Europe and America.

Livy as a Politician.

(*Concluded from page* 376.)

Now to say that the trial and speech of Demetrius were intended directly to plead for mercy towards the young prince Agrippa would make it almost necessary to assume that the scene was inserted in Book XL at a date later than the first writing of the Book; it could indeed be easily detached at the cost of rewording a single sentence. This would, however, be to outrun any definite evidence so far pointed out; but the fourfold parallel of Philip, Perseus, Antigonus, and Demetrius, to Augustus, Tiberius, Agrippa, and Agrippa's youngest son, is a matter of history, not of the historian's treatment. We may guess that Livy shared Augustus' own dislike of Tiberius, since Livy retired from Rome to Padua after Tiberius came to the throne; and such a mind as Livy's must have felt keenly the pathos of the exile of young Agrippa and of his mother Julia; and the hardly less pathetic alternations of affection and suspicion by which the aged Augustus was torn.

In any case, his painting of the tragedy of Demetrius was an eloquent, though not quite explicit, protest against the dangers of the dynastic system. Livy's attitude had a certain effect, as we know, on the history of the next fifty years, by inspiring some of the would-be republican opposition to the Emperors Tiberius and Nero; and we are bound also to connect with it the happier days of the post-Flavian Emperors, that is, roughly speaking, of the second century A.D., when great rulers like Trajan were chosen and chose their successors, not in their family but from the best of their lieutenants. For us, at all events, Livy's treatment of the story is a clear record of his loyalty to the principles of just and merciful government of which the great Romans, whose portraits he drew—Publicola, Scipio, Papirius, Cato, Flamininus—have been for all ages the living presentment.

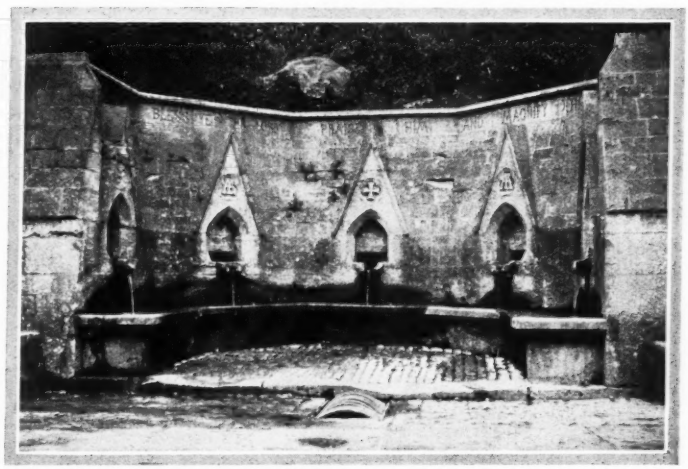
Holy Wells in Legend and History.

By R. C. S. Walters.

Well-worship was practised in the time of the Druids and has persisted down to the present day, as the author shows in an interesting research into the legends and history of holy wells.

"The customs, long preserved among the mountains,
Should not be lightly left to pass away.
They have their moral, and we often may
Learn from them how our wise forefathers wrought.
When they upon the public mind would lay
Some weighty principle, some maxim brought
Home to their hearts, the healthful product of deep thought."—
Edwardes.

SIR LAWRENCE GOMME has pointed out that the study of holy wells is a matter of historical science; the "worship" of water, in some form or another, both in the present and in the past, is world-wide. In Great Britain several conditions prevail respecting the form of worship, the offering, the deity, spirit or guardian saint of the well, and the blessing conferred. Generally speaking "well-worship" has come successively under the influence of Druids, Celts, Romans, Saxons, Danes, Normans, Roman Catholics, and Puritans. At one time it has been made compulsory, at another, it has been forbidden; it has been altered and modified to suit the beliefs (and disbeliefs) of different peoples.



"SEVEN WELLS," AT BISLEY IN GLOUCESTERSHIRE.
The sacred number *seven* in connexion with springs is used frequently in this county.

Before going further, perhaps it may be as well to say exactly what is meant by a "holy well." All village wells are not necessarily holy wells. A "holy well" is (1) nearly always a natural *spring* of water, *i.e.*, not a *well*; (2) has some local tradition of miraculous powers in curing disease, generally "sore eyes"; (3) has a miraculous power of granting a wish; (4) bears the name of a saint. It is generally marked on the six-inch ordnance maps in old English letters which denote antiquities or ancient monuments. There are, however, many undoubted holy wells that are not so marked.

Again, a holy well is *not* an emblem of Roman Catholicism; so much has been written and said of Lourdes, and St. Winifred's Well at Flint, that many people think a holy well has some special significance for Roman Catholics. This is not the case, for there are hundreds of holy wells in England, many of which are decorated with flowers once a year under the auspices of the Church of England.

And lastly, a holy well is not necessarily a spring yielding a mineral—or spa-water; occasionally a holy well is Chalybeate (ferruginous), but in most cases the waters that flow from holy wells are ordinary spring waters, some soft, some hard, some polluted, some piped from the town or village waterworks.

The writer has talked to hundreds of country folk about holy wells, the consensus of their opinion being that "the story of the holy well is nice for the children; it is not really true, of course, that the old Saxon Stone goes down to drink at 'Our Lady's Well,' but the children believe it and we believed it when we were children; and my dad's father when he was a child believed it too, he used to tell us"; and again, "Our Lady's Well be where ancient ladies used to wash!"

In Scotland, the attitude of the country people towards holy wells at the present day, is summed up exactly by the prayer of the old Scotch peasant worshipping at a holy well when he prayed "O Lord, Thou knowest that well would it be for me this day, an' I had stoopit my knees and my heart before Thee in Spirit and Truth as often as I had stopit them after this well. *But we maun keep the customs of our fathers.*"

ST. CHAD'S WELL AT LICHFIELD.
Thousands visit this well every Ascensiontide, when it is decorated with flowers.

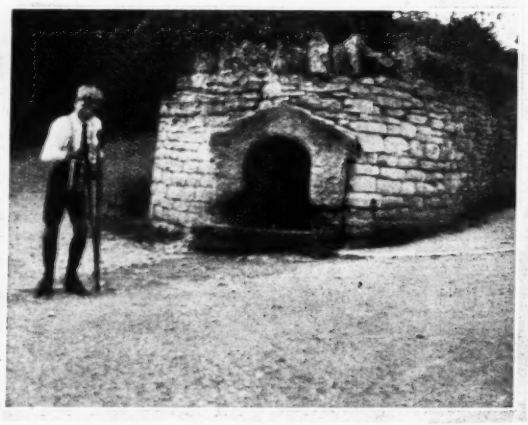
A typical prayer of an Irishman at a holy well is, "I offer up this button, a bit of the waist-band o' my own breeches, an' a taste o' my wife's petticoat, *in remimbrance* of us having made this Holy station; an' may they rise up in glory to prove it for us in the last day."

Such examples are typical of the ideas held at the present day by villagers (and some townsmen too) concerning hundreds of holy wells in the British Isles.

Among the present day customs performed at holy wells, handed down through generations, are some of the most interesting branches of British folklore. In Scotland, Ireland, Wales, and Cornwall there are holy wells which are believed to effect cures and grant wishes, and these wells are usually dedicated to human priests, hermits, or local saints. In Scotland and Ireland there is rain-producing and sun-worship influence, offerings of rags, pins, and money. In some northern counties of England, too, we have the offerings of pins and rags for the purpose of obtaining wishes or for the curing of disease. In the Midlands, the curing of disease is absent, but decorating the wells with flowers once a year is much in vogue. Many wells bear names after Saxon saints: St. Chad's Well, St. Cedd's Well, St. Kenelm's Well, St. Tabitha's Well, St. Aldhelm's Well. The names of some wells suggest Pagan origin, Thor's Well, Waulm's Well, Wanswell (and St. Anne's Well) or Woden's Well. There are many early Christian wells—St. Mary's Well, Our Lady's Well, and wells called after saints such as Anthony, John, Peter, Helen. There are a few wells of more recent origin (as far as the name indicates) such as Fair Rosamund's Well. Again there are such places as Ninewells and Seven Springs; there are no less than eight places named Seven Springs in Gloucestershire alone, all of which from their very name may be considered "holy." In 1618 John Smythe of Nibley wrote of the Seven Springs situate in the magnificent valley of Ozleworth Bottom, "*sed non nascitur ridiculus mus* (as the proverb of Erasmus is) but *nascuntur septem sancti fontes*, seven excellent springs of admirable water and Holy Virtue issue forth in restless abundance at the foot thereof."

The Druids often built their altars near springs and streams and the water therefrom was used for their mystic ceremonies. There are some instances of dolmens (or stone tables) and cromlechs near springs. It is probable that many churches were built on the sites of such dolmens. Sir Norman Lockyear holds that certain dolmens were oriented with springs; in particular, he says that St. Clare's Well and the Trevetha Cromleck are in line with the May sunrise and also the Madron Well in Cornwall, so that the priest that officiated at the altar would face the sunrise; he thinks that the customs now performed at holy wells at Ascension are due to the influence of the old Druidic May-year. It is recorded that St. Patrick came to a fountain called "Slaun," to which the Druids offered sacrifices and which they worshipped as a god.

It seems probable that the Romans were mainly responsible for many of the customs in the worshipping of water as it exists at the present day over the greater part of the world. In particular, it seems certain in this country that the Romans were the first to introduce the custom, still kept up in many parts of England, of decorating wells with flowers and throwing into them flowers, pins, and coins. In Rome the feast of Fontinalia was celebrated in honour of the



BOY FETCHING WATER FOR HIS LAMENESS FROM HEMLOCK WELL.
Belief in the healing power of waters is still retained in the locality of many holy wells.

nymphs of wells and fountains ; Horace thus celebrates the spring on his own farm :

> *O Fons Bandusiae splendidior vitro*
> *dulci digne mero non sine floribus.*
> [" O Bandusia, fountain clearer than crystal
> worthy of sweet wine and flowers withal."]

Seneca writes, " where a spring or river flows, there should we build altars and offer sacrifices." Pliny describes the visibility of the *stipes* or small Roman coins in the Clitumnus, a small river in Umbria. The source of this river was renowned in ancient times, divine homage being paid with *stipes*, there, to Jupiter Clitumnus.

With the coming of the Romans into Britain, we may conclude that this Roman custom came too ; and it is easy to imagine that this pleasant fashion was suitably modified to conform with the bidding of Messrs. Woden and Thor in the era that followed the withdrawal of the Romans. There are fifteen St. Helen's Wells in Yorkshire at the present day, the St. Helen being the mother of Constantine the Great, who was born at York ; there are also some " Roman Wells " and " St. Julian's Springs "—names which date from Roman times ; and there is Wansford (Wans=Wodens) both in Northamptonshire and Yorkshire, a Wanswell in Gloucestershire, and a Thor's Well in Yorkshire, dating from the Pagan time that followed.

Pagan Waters Blessed.

In the second council of Arles in 452, it is recorded that " if in the territory of a Bishop, infidels light torches or venerate *trees, fountains or stones*, and if he neglects to abolish the usage, he must know that he is guilty of sacrilege."

In practice, bishops found this easier to read than to carry out, and this was realized by Pope Gregory in 601, when he wrote thus to Abbot Mellitus :

" When Almighty God shall bring you to the most reverend Bishop Augustine, tell him what I have, upon mature deliberation on the affair of the English, determined upon ; namely, that the temples of the idols in that nation ought not to be destroyed, but let the idols that are in them be destroyed ; let Holy water be made and sprinkled upon the said temples ; let altars be erected and relics placed. For if the temples be well-built, it is requisite that they be converted from the worship of devils to the worship of the true God ; that the nation seeing that their temples are not destroyed, may remove error from their hearts, and knowing and adoring the true God may the more familiarly resort to the places to which they have been accustomed."

The bishops therefore permitted the continuance of pagan worship under Christian control, the water of the pagan wells was blessed and they became holy wells. They were used for baptismal purposes, as chapels and oratories ; and the images of saints were erected near the sacred springs. Thus the old customs became not only absorbed, but intensified by Christianity. These customs throve during the great monastic revival of the seventh and eighth centuries, and survived the coming of the Danes and consequent destruction of many of the monasteries in the ninth ; a century later they were unaffected by the decline of the religious life in the monasteries, for we find that in 963 Edgar, enjoined the clergy to " withhold people from the worship of fountains."

In 1102, Anselm issued the edict " let no man attribute reverence or sanctity to a fountain *without the Bishop's authority.*" By this time certain holy wells were very strongly established and many were controlled by monasteries. A " miraculous " water would attract thousands of pilgrims, a considerable source of revenue to a monastery ; the fame of Winchcomb (the ancient capital of Mercia) was probably entirely due to the miraculous St. Kenelm's Well dedicated to the the Saxon boy-king.

There are several holy wells dedicated to Saxon saints, the most important being St. Chad, who was especially associated with water and springs ; one of the finest springs in the country is dedicated to him, namely Chadwell, near Hertford. This spring has been used for part of the London water supply for the last three centuries. There is a St. Chad's Well at Lichfield, which is decorated with flowers every Ascensiontide, when thousands of people attend and pay homage at the well where St. Chad preached and baptized his converts. There are several other St. Chad's Wells, such as those at Tewkesbury, Lastingham, Wilne, Gnosall, and Midsomer Norton.

In 1536, Latimer preached against holy wells, and in the time of Henry VIII General Bassett wrote to Lord Cromwell thus :—

" According to my bounden duty, and the tenor of your lordship's letters, I have sent your lordship by this bearer, my brother, Francis Bassett, the images of St. Anne of Buxton, St. Andrew of Burton-upon-Trent, which images I did take from the places where they did stand and brought to my own house, in as sober a manner as my little and rude wits would serve me.

In order that there should be no more idolatory and superstition there used, I did not only deface the tabernacles and places where they did stand, but did also take away crutches, shirts and shifts that were offered.

I have locked and sealed the wells at Buxton that none shall enter or wash there till your lordship's pleasure be further known."

The crutches alluded to above were those of the lame that had been cured, and the " shirts " and " shifts " were the customary " rag " tokens, most probably symbolical of the curing of disease and the

THE FIVE HOLY WELLS AT TISSINGTON IN DERBYSHIRE.

As described in the text opposite, the wells are decorated every Ascension Day by the villagers, and a religious ceremony is performed in the course of which each well is visited.

(1) The Hall Well, formerly dedicated to St. Helen. (2) Hand's Well, near the house of Farmer Hand. (3) The Yew Tree Well. (4) The Town Well. (5) The Coffin Well, so called from the shape of the surrounding stonework. (6) The Hall Well, decorated for the annual service which is seen in progress.

casting away of the unclean thing. In 1572 it was said that the image of St. Anne had been miraculously found in the well, and this had given the spring her name.

The history of the well of Our Lady at Walsingham, in Norfolk, is interesting; Henry VIII was one of several monarchs who had patronized this well. The patronization consisted in walking the last two miles to it barefoot; the King's banner was hung up, and the shrine was covered with gold, silver, and jewels, offerings to what was thought to be the Blessed Virgin's favourite English home.

The destruction of the monasteries and the Reformation were no more successful in stamping out the ceremonies and faiths connected with holy wells than were the Councils of Arles or the Edicts of Anselm, for even to-day local country or town people may continually be found who have strong belief in the efficacy of water from a holy well, especially for "weak eyes." The writer came across an instance of a little boy going to fetch water for his lameness from Hemlock Well.

A Modern Survival.

Some wells still have ceremonies performed at them. Perhaps the most remarkable are those at Tissington in Derbyshire. Tissington is a pretty village, situate between Buxton and Ashbourne near the beautiful gorge of Dovedale. There are five "wells" or springs having large quantities of water gushing out of the rocks of mountain limestone. They are seen in the accompanying illustrations, and are called (1) the Hall Well (formerly St. Helen's), opposite Tissington Hall, the ancestral home of the Fitz-Herbert family; (2) Hand's Well, near the house of Farmer Hand; (3) the Yew Tree Well, under a very dark yew, formerly called Miss Goodwin's Well; (4) the Town Well, at one time called Holland's Well; and (5) the Coffin Well, formerly Frith's Well, so called because the stonework surrounding the well resembles a coffin.

The wells are decorated on every Ascension Day (Fig. 6)* by those who live nearest to the wells, and great rivalry exists as to which well shall be decorated in the best way. The design of the decoration for each well is different every year. For the mosaic and other designs, the flowers are inserted in moist clay on boards, cut in various shapes, and they are arranged in fanciful patterns to give the appearance of mosaic work. There are also letters and sentences of appropriate quotations formed in flowers, petals, rice, or Indian corn. Five short services are held at the five wells by the rector (Fig. 6), and occasionally by the Bishop of the Diocese.

*Photograph (Fig. 6) reproduced by permission of Mr. H. Hinge of Ashbourne.

From an account of the ceremonies held in 1823 we read, "An ancient observance still prevails on Holy Thursday at Tissington, which not only claims high antiquity but is one of the few country fetes which are kept up in anything like the ancient spirit; it is called well-flowering."

On 8th May, 1823, a sermon was preached in the church from 1 Peter, iii, 22. Then the congregation walked to the Hall Well, where the First Psalm of the day was read. The well was decorated with laurels, daffodils, Chinese roses, and marsh-marigolds, with the words "While he blessed them he was carried up into Heaven" in white and red daisies.

Hand's Well was decorated with laurels and a canopy with the sentence "the Lord's unsparing hand supports us from this spring" in letters of larch buds, purple primroses, and marsh-marigolds. Above the spring, on a moss ground, in letters of white daisies, "Sons of the Earth in triumph join." Beneath was formed, in auriculas, "G.R." The Second Psalm of the day was read at this well.

The Coffin Well had two arches, one within the other; the first had a ground of white hyacinths and purple primroses edged with white, on which was inscribed in red daisies "Ascension." The receding arch was covered with various flowers, and in the centre on a ground of marsh-marigolds, edged with white hyacinths, in red daisies, "Peace be unto you." Here was read the Third Psalm.

The Town Well was surrounded with blackthorn and in the centre of the circular stone arch, on a ground of marsh-marigolds edged with purple primroses, in red daisies, were the words "In God is all." At this well was read the Epistle.

The Yew Tree Well had branches of evergreens, with a painted arch covered with marsh-marigolds, daffodils and wild hyacinths with "He did no sin" in red daisies. On the summit of the arch a crown of laurel over which was a cross of white daisies, edged with wild hyacinths, and on the transverse piece of the cross the letters "I.H.S." in red daisies. At this well was read the Gospel.

BIBLIOGRAPHY.

R. C. Hope. "Holy Wells of England." (1893).
M. and L. Quiller-Couch. "Holy Wells of Cornwall." (1894).
W. Smith. "Ancient Springs of Yorkshire." (1923).
E. Horne. "Holy Wells of Somerset." (1923).
R. C. S. Walters. "Holy Wells of Gloucestershire." (*Bristol Times*, 22nd May, 1926, *et seq.*)
Sunderland. "Old Spas of London." (1917).
Sir G. L. Gomme. "Folklore as an Historical Science." (1904).
Sir Norman Lockyer. "Stonehenge and other Monuments astronomically considered." (1909).
R. P. Masani. "Folklore of Wells." (1918).

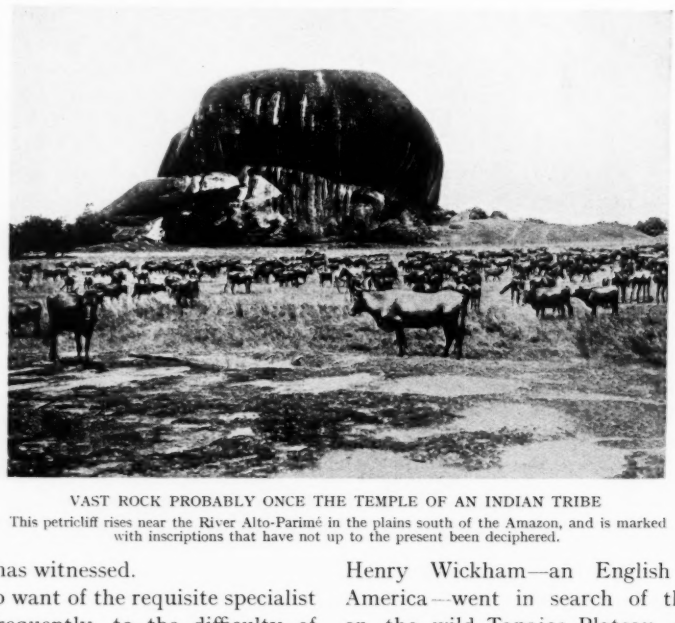
Scientific Problems of the Amazon Valley.

By Charles W. Domville-Fife.
Author of "Among Wild Tribes of the Amazons."

Exploration in the Amazon Valley has revealed a number of scientific problems which still await explanation. Although observed by the author through lay spectacles, the phenomena here described suggest that much specialist investigation has still to be made in this region.

ALTHOUGH the Amazon is the greatest river in the world, and passes through a region covering millions of square miles of unexplored country, it is so little known from the scientific standpoint, and so little developed commercially, that to-day—388 years after the Portuguese explorer Francisco de Orellana first penetrated the surrounding forests and sighted its yellow waters—there are countless problems still awaiting investigation and solution.

Every explorer finally emerges from the dim green twilight of the Valley dazed and bewildered by his inability to reduce what he has seen to scientific order, or even definitely to assign a reason for many of the curious phenomena he has witnessed.



VAST ROCK PROBABLY ONCE THE TEMPLE OF AN INDIAN TRIBE
This petricliff rises near the River Alto-Parimé in the plains south of the Amazon, and is marked with inscriptions that have not up to the present been deciphered.

Perhaps this is due to want of the requisite specialist knowledge or, more frequently, to the difficulty of conducting lengthy investigations and experiments in face of the vast distances which his primary work of exploration calls upon him to cover before food and medical supplies are exhausted. The great enemy of the traveller who leaves the beaten track in Amazonia is starvation—in one of the most fertile lands in the world.

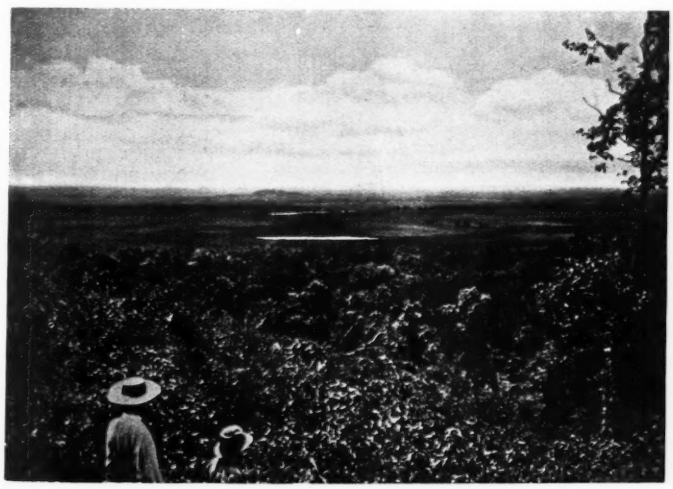
This somewhat lengthy introduction, to what is intended as a resumé of a few of the scientific puzzles which have come under my own observation while in the Amazon Valley, is necessary in order that the many readers, whose knowledge of the subjects involved is undoubtedly far greater than my own, should understand that no attempt is being made to create mystery where it does not exist, but rather to elicit well-informed scientific information and to draw attention to the scope which this wonderful but neglected region offers for organized investigation.

The result of my previous books and articles has been most gratifying in focusing attention on the problems of the Amazon Valley. Last year three scientists of repute visited this great river, bringing back much useful information, but like myself, they realized man's futile efforts in the "Green Mansions" of Nature. Where one explorer now goes an army is really needed.

This region sometimes handsomely rewards its investigators—as, for example, when Mr. (afterwards Sir) Henry Wickham—an English planter in Central America—went in search of the Para rubber seed on the wild Tapajos Plateau, and was successful in obtaining 70,000 seeds which formed the nucleus of the great rubber-planting industry of the East, with a capital now estimated at over £150,000,000. Other less startling discoveries have been made—the finding of oil, diamonds, and balata, to mention but a few—and every month something scientifically important or commercially useful is being brought to light.

A curious phenomenon, noticed by almost every traveller but which does not yet appear to have been satisfactorily explained, is the entire absence of sunstroke in Amazonia, although it is actually on or within a few degrees of the Equator. Sun-helmets, spine-pads, or other appliances for protection against the powerful rays are never worn, and bathing in the

lower reaches of the river is enjoyed by both Europeans and natives, who also take sun-baths on the banks. Very short residence in the Amazon region served to disclose the fact that not only is sunstroke almost unknown, but that instantaneous photography is extremely difficult. Much longer exposures are necessary to obtain good results there than are required in Central Africa or in the Sudan, and a series of exposures I made seemed to show conclusively that the actinic value of the brilliant sunlight, which bathes the Amazon for nine months of the year, is abnormally poor. It is known that sunbeams are robbed of certain violet rays by the moisture always present in the atmosphere, but what is the scientific explanation for the light apparently differing in properties from that in other parts of the tropics? While this phenomenon relieves the explorer of the necessity of wearing protective clothing or tinted glasses when in the forests or river region, it renders amateur photography of native life, or of moving objects, such as birds and beasts, far more difficult, though on some days its effects are found to be less marked than on others.



WHERE THE AMAZON FORESTS GIVE PLACE TO TREELESS PRAIRIE.
The vast forests of the Amazon are bounded on the south by practically treeless prairie, whose agricultural possibilities have yet to be fully investigated.

Another atmospheric peculiarity is the occurrence of electric storms which frequently seem to be soundless and sometimes apparently cloudless. The whole sky is ablaze with vivid flashes of sheet or fork lightning, and the storm may rage for hours, during which time even the forest and river seem to hold their breath in awe.

Connected with the unusual atmospheric conditions is the difficulty of wireless telegraphy in the Amazon Valley. Two ships approaching each other in the broader stretches of the river, where it is not encumbered with islands, can often close to within a few miles before wireless communication is possible. Occasionally they come within visual range before the wireless establishes contact, and rocket signals are then employed. On certain days it is possible, however, to send the ether vibrations across vast stretches of country without difficulty or undue interruption; as, for example, when the messages of the Hamilton Rice Expedition, which last year explored the river territory by hydroplane, were picked up by listeners in the United States. Then came a period when the same expedition was entirely cut off from communication with the outside world.

Another physical curiosity noticed in many parts of the Amazon region occurs each year about the 24th June, when the temperature of the river water in the main stream drops suddenly, and to such an extent that small fish often die. The effect is also noticeable in the air along the river bank, people in settlements as wide apart as Iquitos, Manaos, and Obidos complaining of the sudden cold, and it is possible to wear almost European clothing—at the Equator—for several days. It is believed that the cause of this cold wind and water stream originates over the Pacific, whence the warm "Chinook" wind (or Japanese current) strikes the highest Andes and, robbed of its heat, follows the snow water through the Amazon plain. The factor which makes this theory somewhat difficult to understand, however, is the absolute regularity of the visitation, and the fact that at least 2,000 miles of equatorial jungle intervene between the Andes and Manaos or Obidos.

The regions adjoining the Amazon also present some interesting problems. Though the Amazon boasts the greatest equatorial forest in the world, which stretches from the Andes to the Atlantic Ocean and from one degree north of the Equator to El Gran Chaco in Paraguay and the Argentine, it suddenly gives place to open plains, thousands of square miles in extent, where none but stunted trees are found to grow, in spite of the sunlight and tropical rainfall. Yet, since these prairies produce a particularly nourishing grass, upon which herds of cattle are being fed in increasing numbers, will they ever rival those of the Argentine and North America in the production of one or other of the great agricultural commodities?

A PAMMARY INDIAN.

The precise cause of the curious patches on the bronzed skin of this tribe is not known.

Among the relics of an unknown past found in this region, there is the gigantic rock which rises from the level prairie some way back from the little river Alto-Parimé, and was apparently used as a sacred temple by some long-lost Indian nation; though upon this point information is lacking, because the inscriptions on its surface have never yet been deciphered. Such petricliffs occur in other parts of America, but it is difficult to repress a feeling of awe as one rides out of the open prairie into the shadow of this enormous stone.

A narrow ledge of rock leads, spiral fashion, round the base of the overhanging buttress, and on one side there is a cave capable of sheltering a squadron of cavalry. This dark cavern appears to have been hewn out of the solid rock, for chisel-marks can still be seen, but whence came the labour involved by this gigantic piece of engineering work? High up on the outer surface of the rock is a narrow platform, evidently of artificial construction, but from which there is now no visible means of descent. Over a hundred feet below this curious structure is a natural terrace of level stone. The surfaces of the gigantic boulder are scored and discoloured by centuries of exposure to tropical sun and rain, but except for the evidence afforded by the inscriptions, cut deep into the rock, nothing detailed is known of its history or purpose.

For several centuries stories of white Indians have been told by explorers of many nationalities who have travelled in Amazonia. Sir Clements Markham, Bates, and other serious travellers refer to these people, and their existence is confirmed in the official reports of the Indian Department of the Brazilian Government. Castlenau gives twelve words of the language of the supposedly white Mayoruna tribe, and Bates has an interesting account of a white Mayoruna girl who was captured on the Yavari River. In my book, "Among Wild Tribes of the Amazons," I have described single isolated specimens, among otherwise red tribes, that have come under my personal observation in remote parts of the forests. Contact with these Indians suggests, however, that they are not pure white, but very fair skinned, which shows to a greater extent in contrast with their surroundings. Extreme albinism has been suggested to explain their occurrence, but a systematic investigation of the problem has yet to be made. When questioned these Indians realize only that they are of lighter colour, without being able to assign any reason for it.

Another curiosity in skin colouring is found among the Pammary Indians, an Amazon tribe whose bodies are covered with white and brown patches. Whether this condition is produced by some indelible dye or, as is generally considered locally, it is the result of a curious disease once very prevalent, it is an interesting fact that the ancient name of their habitat, the Rio dos Purus, means the "River of the Spotted Ones." One authority in Porto Velho, a settlement on the Madeira River, has suggested that the yellowish-white patches are caused by drinking the juice of certain poisonous herbs, but, whatever be the reason, the condition is unaccompanied by physical infirmity, and has yet to be satisfactorily explained.

The vegetable kingdom, of course, present scientific problems which are certainly more numerous than the ethnological: the discovery of the Para rubber seed has already been mentioned, and the vast forests of the Amazon abound in interesting species about which little or nothing is at present known.

Origins of Architecture.

Mr. Bell's series of four volumes entitled collectively "The Origins of Architecture," supplies an introduction to the art of architecture which aims at indicating "the sources of a continuous tradition which runs throughout its history and which links the great works of mediæval and modern days with the simple art of prehistoric ages." The present volume* in treatment is complete in itself, and may be taken on its own merits as an account of the Minoan and Mycenean buildings which have been revealed by the spade of Schliemann, Sir Arthur Evans, and many other distinguished excavators. The mass of detailed information on the subject which has been published, especially since the beginning of the present century, is for the most part inaccessible to the layman who is not acquainted with the technical literature, while to the student a general survey such as this is of great assistance. Knowledge of the types of dwelling in Crete and on the mainland is essential if we seek an insight into the daily life of the people, and wish to grasp some of the essential changes brought about by the racial movements of the time. In such matters Mr. Bell brings out clearly the salient features and is a safe guide. E. N. F.

* *Pre-Hellenic Architecture in the Aegean: The Origins of Architecture—II.* By Edward Bell, M.A., F.S.A. (G. Bell & Sons Ltd. 8*s.* 6*d.*).

The Month's Wireless Developments.

THE PROBLEM OF RANGE.

By F. H. Masters.

(Editor of "The Electrician.")

ONE of the most interesting problems with which the radio engineer has to deal is the extraordinary difference in the ranges to which signals of a certain power and wave-length can be transmitted and picked up. These differences depend not only on the transmitting power and wave-lengths themselves, but on the time of day at which transmission occurs, on the relative positions of the transmitting and receiving stations, and on the atmospheric conditions. The state of our present knowledge on the subject was admirably summed up in an address given a few weeks ago by Dr. W. H. Eccles, the new president of the Institution of Electrical Engineers to the Radio Society of Great Britain.

Very long waves, he said, travelled equally well by night and by day, and the distance at which good signals could be received depended on the transmitting power. Waves of the order of 1,000 metres travelled much better by night than by day, while in both cases the strength of the signals received fell off as the distance increased. Waves 100 m. long could be picked up as far as 200 miles away, while waves 30 m. long could be picked up at distances up to 50 miles, were inaudible at distances between 50 and 500 miles, and were again audible at distances between 500 and 1,500 miles. This silent band is known as the "skip," and the shorter the wave the longer the skip. At night these distances are increased, and during the hours of darkness a 20 m. wave has been heard at distances exceeding 7,000 miles, but not at shorter distances. As a broad rule, after the "skip" has been passed, the signal becomes stronger the longer the distance, though there are times, generally in the middle of the night, when signals do not come through. It therefore appears that short waves are more useful than long waves for distances up to 1,000 miles at night. Beyond this distance the relative utility of long and short waves depends on the work that is being dealt with. Short-wave stations are cheaper to erect, but long-wave stations are probably more reliable.

It should be noted that the results given are those which may be expected during constant operation. There are, in addition, cases of extreme ranges being covered, often with very elementary apparatus, but these, though thrilling to the particular experimenter, must not be taken too seriously either technically or commercially. The true explanation of these differences will only be obtained from a closer study of the way in which radiant energy is propagated over the surface of the globe. This means that our knowledge of the part played by the upper atmosphere in guiding or dissipating wireless waves must be extended.

The Heaviside Layer.

It is now generally accepted that wireless waves travel round the earth instead of spreading out in straight lines like rays of light. This bending was attributed by Heaviside to the presence of a good conducting layer in the upper atmosphere which, in conjunction with the sea water below, confined the waves between two conducting surfaces. As is well known, the air though usually non-conducting can be rendered conducting or "ionized"; and one of the chief factors in this ionization is probably the solar rays. The presence of this ionized atmosphere may provide a layer, which acts as a reflector. That the Heaviside layer theory fits in fairly well with the practical results obtained is admitted, but it cannot be accepted as gospel until a great deal more data has been accumulated. On the assumption that such an ionized layer exists, Dr. Eccles and Sir Joseph Larmor have both propounded theories, which tend to show that this layer would cause the upper portions of a wave to move more quickly than the lower. Thus, instead of being straight, the path of the waves would be curved, and one particular curvature would enable waves to extend round the earth. The great distances that are covered by short waves may therefore be explained as being due to the combined influence of atmospheric properties and solar radiation.

BRITISH BROADCASTING: PAST AND FUTURE.

By Edward Liveing, M.A.

(Manchester Station Director, B.B.C.)

THIS month sees the fourth anniversary of the British Broadcasting Company's inception. Certain critics of broadcasting in the past used to say that "the new craze could not possibly last," others that broadcasting would never be more than a means of entertainment and that it should be regarded purely and simply as a large entertainment industry, while others with vested interests to guard declared that it would do infinite harm to those institutions hitherto exclusively concerned with certain forms of catering for the public's entertainment and interest. It may safely be said, now that the early pioneer days are over, that none of those critics have been right in their prophecies. British broadcasting stands to-day at the head of the world's broadcasting organizations from the point of view of the ideals pursued, the quantity and quality of the programmes, and the efficiency of the whole system, and it owes its supremacy on one side to the traditions of the race from which it has sprung, and on the other side to the fact that there have been men at the head of it who have wisely followed the best of these traditions and at the same time been ready to lead the public forward through this new medium of expression to new aspirations, ideals, and interests.

In his memorandum of information presented by Mr. J. C. W. Reith (Managing Director of the British Broadcasting Company) to the Broadcasting Committee, which sat in the late months of 1925, he described the policy and standards which have governed the broadcasting organization in this country. "Broadcasting must be conducted," he said, "in the future as it has been in the past, as a Public Service with definite standards. The Service must not be used for entertainment purposes alone. In the narrow sense of the term this may once have been considered its only function, but to exploit so great and universal an agent in the pursuit of entertainment alone would have been not only an abdication of responsibility and a prostitution of its power, but also an insult to the intelligence of the public it serves. The broadcasting service should bring into the greatest possible number of homes in the fullest degree all that is best in every department of human knowledge, endeavour, and achievement. Rightly developed and controlled it will become a world influence with immense potentialities for good—equally for harm, if its function is wrongly or loosely conceived. The preservation of a high moral tone is obviously of paramount importance. Everything definitely vulgar or hurtful must of

course be avoided, but apart from this there are many subjects which the service must exclude, since the liberty of one is the stumbling block of another. It must also be remembered that children of all ages are among the listeners to almost every broadcast. There are abuses which broadcasting should combat at once, and which it has in fact endeavoured to combat in the past; there are others which it may need to combat later, but which meanwhile it certainly does not assist. Popularity must not be sought in ways where it is soonest found; the builders of programmes must possess idealism, however dangerous to confess. He who prides himself on giving what he thinks the public want is often creating a fictitious demand for lower standards which he himself will then satisfy. Policy must be clear, consistent, and courageous. It is in this sense that the B.B.C. have conceived their responsibility and endeavoured to discharge it."

At the end of this year the British broadcasting organization becomes a national trust under the title of the British Broadcasting Corporation, and it may truly be said that this development is the logical outcome of the ideals and past activities of the British Broadcasting Company.

Canada and Australia.

In the July issue of *Discovery* a general description was given in these notes of broadcasting activities in our great dominions, and a promise was made that in some future issue an outline of the educational side of broadcasting work in these countries would be undertaken. The situation in Canada and Australia is perhaps most interesting of all. To the inhabitants, both young and old, of these vast tracts of country wireless has come as a greater boon than to those races in the older parts of the world where the population is thickly clustered together. Canadians owe a great deal to the various organizations that have been set up in Canada, and in particular to the chain of stations, including Ottawa, Moncton, and Vancouver, organized by the Canadian National Railways. It may be interesting to know that this year all the broadcasting stations of Canada have joined together and formed themselves into an association called the Canadian Association of Broadcasters, which has obtained a charter under the Companies' Act. One of the aims of this association is to spread a greater knowledge of the country and its opportunities to Canadians. This in itself will entail work of a general educational value. Another interesting new feature of Canadian broadcasting is mentioned in a statement issued early this year by the Canadian Manufacturers' Association. This statement says that the lectures hitherto given each Friday from Toronto to high school students in Ontario are now being repeated by other stations in Canada, including Ottawa, Vancouver, and Moncton.

It is considered that the opportunities of wireless education offered to growing Canadians will be within reach of 90 per cent of the 162,000 high school students from the Atlantic to the Pacific.

From Australia comes the news that the Director of Technical Education for New South Wales has recommended in his report to his committee on education that standard receiving sets should be devised for schools, and that all sets used in schools should be inspected by officers of the education department. This is a development of very considerable importance. Though it is obvious from other reports that the New South Wales Public School Teachers' Federation does not favour the regular routine class teaching by wireless, so much interest has been created by the wireless tests made last year at Bourke on behalf of the Ministry of Education, that this Federation intends at any rate to supplement the work of the teacher through wireless. This new movement is not only designed for children, but also to keep those adults living in the sparsely-populated country in touch with the news of the day, literature, music, drama, and new knowledge of all kinds. In fact, the idea is to install receiving sets in the schools of country districts, special transmissions being given for children during the day, and to congregations of adults during the evening. It is believed that this movement of bringing, so to speak, the interests of the town into the country, will stop the present dangerous drift in Australia from country districts into the urban centres.

Book Reviews.

The Naturalist's Guide to the Americas. Assembled and edited by VICTOR E. SHELFORD. (Ballière, Tindall & Cox. 45*s*.).

This remarkable book of over 700 pages of closely-printed double columns is packed with facts and forms a compendious survey of the oecology of North America, Central America, and certain of the northern South American republics. It is the outcome of a committee which nine years ago was charged with the task of preparing lists of all the " preserved " and preservable areas in North America. These lists having been completed, the next task was to urge the preservation of such important areas as demanded immediate attention. At the outset the committee felt the need of definite details and guides, and to provide these the present volume has been prepared under the supervision of two members for each State in the Union and for each Province of Canada. Not only did these members supply information, but they undertook to interest some local authority in the work they had at hand. On all sides they met with cordial support, and their efforts were much lightened by the close co-operation of the United States Forestry Service.

In the main the book deals with the climate, the conditions of the land, the geological formation of the country, the flow of the rivers, the natural drainage areas, and the living plants and animals which occur in these areas. American States are frequently, except on the eastern slope, separated from one another by a straight line following no natural feature. Of course, the plants and animals are unaware of this line, and although they may be shut off occasionally by mountains and more often by deserts, they readily pass across these theoretical boundaries and thus the flora and fauna get dreadfully mixed up.

The whole book covers the area from Greenland on the north to Venezuela on the south. To give some idea of its contents we might perhaps describe in a little more detail the State of Florida. Each State is treated on somewhat the same lines, but as one State differs from another in so many particulars it is difficult to arrive at a greatest common measure. Florida, in spite of Miami, is largely an area of numerous swamps, shallow lakes, sluggish, ill-defined, crooked streams with low, swampy mud banks. Towards the north, however, the land is hilly and rolling, but on the coast line there is a series of sandy reefs and shallow islands enclosed by narrow inlets of the ocean often called rivers. The underlying rock is largely limestone, which accounts for the large number of lakes and numerous

subterranean streams. From north to south the climate differs markedly. The lowermost end is practically tropical. The soils are mostly sandy. The plant life is materially interfered with by torrential rains in summer, when the streams become brown with organic matter. On the other hand, in the dry season fires are frequent. There is a marked dry and wet season in Florida. The authors divide the vegetation of the State into five groups, those of the everglades, those dreary regions of swamp, perhaps the most god-forsaken part of "God's own country." These dry up during the winter and spring and become covered with tall grasses and sedges. Here and there is an eminence crowned with trees which generally support that melancholy-looking epiphyte known as Spanish moss. In these Savannahs the Florida duck, the Florida redwing, several species of heron, the American egret, the burrowing owl, the swallow-tailed kite, and various sand-pipers are amongst the commonest birds, and here again we still find the *Alligator mississippiensis*, also the marsh-rat, the otter, the mink, and the racoon. There are further several kinds of snakes and snapping turtles, also the soft-shelled turtle and, in the extreme south, grows a second species of crocodile, *Crocodilus acutus*. In such an aqueous part of the world it is not surprising that we find many amphibia.

Mosquitoes abound, but the malaria-carrying Anopheles is, however, comparatively scarce. On the other hand, in the late spring horse-flies are extremely abundant and irritating. The four other regions are dealt with in an equally exhaustive manner, and one may mention that at the end of each section of the book there is a very useful bibliography.

Throughout the book efforts more or less successful have been made to give an account of the insect fauna, but apart from these and occasional references to the mollusca the invertebrate fauna is but slightly touched. The index, however, leaves something to be desired, though the birds are very fully "listed." Altogether the book is a marvellous record of innumerable facts carefully classified, and it cannot fail to do much to promote the preservation of natural areas and to prevent the destruction of the native flora and fauna.

A. E. S.

Ice Ages, Recent and Ancient. A. P. COLEMAN, M.A., Ph.D., F.R.S., Emeritus Professor of Geology, University of Toronto. (Macmillan & Co. 17*s*.).

Geological knowledge advances so quickly, and it is so difficult to keep in touch with all recent research, that students will welcome the appearance of this volume by Dr. Coleman, who is so eminently equipped both by his environment and his extensive travels to deal with the subject. The author naturally deals first with the Pleistocene Ice Age of N. America, passing on to the same period in other parts of the world, and a summary is given of the presumed results of this glaciation. He then deals with the earlier Ice Ages, the Eocene glaciations in Antarctica and N. America, and the Mesozoic and Palaeozoic glaciations which have been postulated for so many parts of the world. Finally the various theories that have been propounded to account for Ice Ages are subjected to criticism, and the conclusion is that they are inadequate to account for all the facts, a conclusion which will receive the support of most students. A word of praise must be given to the excellent illustrations which accompany the work, all drawn from extra-European sources and therefore more interesting to the English reader. With one possible exception they do illustrate the work, and are not mere pictorial adornments of no real relation to the subject-matter.

The book is written from the viewpoint of the orthodox glacialist, one who accepts without question the view that vast areas of the northern hemisphere were in Pleistocene times buried under recurring ice sheets sometimes 10,000 feet thick, with warmer interglacial periods, four being accepted for N. America and three for Europe.

These conclusions are based on statigraphical evidence, and tribute must be paid to the skilful manner in which the facts are marshalled in support of these views. Of particular importance are the descriptions of those Palaeozoic deposits which are presumed to indicate glacial conditions; nearly all the accounts being based on the personal observations of Dr. Coleman. All students are under a deep debt of gratitude to the author for thus placing at their service a concise account of geological facts which hitherto had been scattered throughout many journals and periodicals often difficult to consult.

But there is another side to the medal to which Dr. Coleman does not allude. In England for many years the palaeontologists have refused to accept the theories of the glacialists, and their position has been stated by Dr. R. F. Scharff ("The History of the European Fauna"). In his lately published "Monograph of the Voles and Lemmings," Mr. M. A. C. Hinton has definitely stated that the only evidence from his viewpoint for glaciation is at the last stage of the Pleistocene. No attempt so far has been made to answer the objections of the palaeontologists, and one cannot help noting that Dr. Coleman ignores altogether the writings of the late Sir Henry Howorth, whose destructive criticism of the glacialists has yet to be countered. But, after all, toleration of divergent views is one of the cardinal virtues of geologists, and by none will Dr. Coleman's book be more welcomed than by those who differ from him.

A. S. K.

The Elements of Astronomy. By E. A. FATH. (McGraw-Hill Book Co. 15*s*.).

This book is a non-mathematical treatment of astronomy for the benefit of the general reader. Most of the books written for this purpose are little more than a recital of "marvels" which stun the reader in a few pages. Astronomy, unfortunately, lends itself to this kind of treatment, with the result that books in which the subject is treated scientifically and yet remain intelligible to the average man are very few indeed. Professor Fath's work fills this gap in astronomical literature in a very able manner, and can be unreservedly recommended to those who wish to learn something real about modern astronomy.

After an enthusiastic introduction, the author gives a clear and up-to-date account of astronomical knowledge, and except for a few formulae, which only require a knowledge of arithmetic to understand, there is practically no mathematics. For example, in the chapter on gravitational astronomy, a short account is given of the verification of the law of gravity by means of the moon's motion, and arithmetic only is used. This piece of work, due to Newton, is the beginning of modern theoretical astronomy, and will give the reader an insight into the way the motions and orbits of the planets can be deduced from this simple law.

After studying the earth, a clear account is given of various astronomical instruments and methods, and then we have a survey of the sun, planets, stars, etc., and brief accounts of the most modern theories as to the origin of the solar system and the evolution of the stars. The book, which is interesting throughout, contains accounts of such things as the remarkable discovery of Neptune, and deals with the companion of Sirius. This companion, it is thought, is made of such material that

a portion the size of a pebble would weigh about a ton. As the treatment is limited to three hundred pages, there is some compression, which takes place mostly in the theoretical parts of the subject. Little that is of interest to the general reader has been omitted. The book is well produced and contains many beautiful photographs of nebulae.

Incidentally it is pleasant to see that English names are still foremost in theoretical astronomy. C. F.

The Atmospheric Nitrogen Industry. By Dr. Bruno Waeser. Translated by Ernest Fyleman, B.Sc., Ph.D., F.I.C. (J. & A. Churchill. Two vols. 42*s*.).

The aim of this book is to give a comprehensive account of the present state of the industries concerned in the production of nitrogen compounds from atmospheric nitrogen. These compounds may be regarded as the life-blood of mankind, for upon their fertilizing properties depends, to a large extent, the growth of the crops required to feed the steadily-growing population of the world Before the war, they were mainly derived from the naturally occurring sodium nitrate of Chile and the ammonia obtained as a by-product from the distillation of coal. Since that time, the work of a number of chemists (culminating in the investigations of Professor Fritz Haber) has led to the establishment of a world-wide industry for utilizing atmospheric nitrogen. The processes employed are mainly of three kinds: (1) The arc process, whereby the oxygen and nitrogen of the air are converted to nitrogen oxides by passage through an electric arc; (2) The cyanamide process, whereby various metallic carbides are heated with nitrogen from the atmosphere, yielding nitrogenous compounds known as cyanamides; and (3) The direct ammonia synthesis, in which nitrogen is converted to ammonia by direct combination with hydrogen in the presence of auxiliary substances known as catalysts. For a variety of reasons, the direct ammonia synthesis is the most generally applicable. The growth of the industry within recent years may be judged from the fact that Chilean nitrate, once almost the sole source of combined nitrogen, supplied in 1925 only about one-third of the world's needs. It is true that threatened industries, like threatened men, sometimes live long; but it is unlikely that Chilean nitrate will in the future play any part other than that of an auxiliary to the products derived from atmospheric nitrogen.

Dr. Waeser's book divides the subject into two main sections. In the first—historical and economic—the development of the atmospheric nitrogen industry is dealt with. Country by country, the world industry is considered in all its bearings. A discussion is given in each case of the available electric power, a use of which is involved in some processes; and by-product ammonia is also brought in, for comparative purposes. In the next section (Volume II) the technical side of the subject is considered at length. This involves not only the detailed discussion of each process—around which subject there has grown up a literature the extent of which is, even to the technical chemist, simply terrifying—but also of the production of the necessary gases. Many other points also arise for treatment, such as the oxidation of ammonia to nitric acid. The immense difficulty of giving a fair account of the whole subject may be summed up in the words of the author's preface: "The Great War occurred and the young industry developed greatly under its influence. This development is reflected in the size of the present volume, which greatly exceeded that which was anticipated. It was often very difficult to collect the material, and I must appeal to the indulgence of my readers, as the most conflicting data are to be found in the German and foreign literature. In general, I was able to deal with the literature up to the middle of March, 1921." In order to make the account given more up-to-date, each chapter ends with a short supplement giving an outline of the advances occurring in the period 1921-24.

It is always difficult to treat, in book form, a subject which is developing from day to day. In the supplement to the chapter on the British nitrogen industry it is stated (p. 224) that "the production of synthetic ammonia is at the moment still unimportant. . . . The Billingham works are expected to commence production in 1923-24 on behalf of Brunner, Mond & Co. Ltd." Actually, of course, the present position is that the Billingham works (which are being operated by Synthetic Ammonia & Nitrates Ltd., a company associated with Brunner Mond's) is running at high pressure, and producing a large amount of ammonia and its derivatives. Moreover, at least one Casale plant is under construction for the same purpose. It would, however, be unfair to damn Dr. Waeser's book with faint praise. He has attempted a giant's task. Since the war ended, the best engineering and chemical brains in the world have been engaged in the constant improvement of the nitrogen fixation processes, and progress is so rapid that it could be confidently predicted of any book now projected on the subject that (as regards statistics and technical details) it would probably be rendered out of date by the march of events while it was in the hands of the printer. As far, however, as concerns the time up to the end of the first post-war period, Dr. Waeser has collected an enormous amount of valuable material. It would seem advisable to supplement it as soon as possible by the issue of a further volume, dealing with more recent events, even if this be done in only small compass. In any case, the volumes under discussion provide information which should be of considerable value to those engaged in the exhaustive study of the subject.

B. F.

A Bipolar Theory of Living Processes. By George W. Crile. (The Macmillan Co. 21*s*.).

The reason which led the author to formulate the theory forming the title of his work, was the observation that in a young and strong man who "had lost but little blood although both legs had been crushed by a locomotive," and in whom every organ of the body was sound, the bodily energies failed. ending in death. *Why?*

To answer this question Dr. Crile set out to "understand the nature of life itself." In this book he sums up a large number of experiments designed to this end, and as a result he advances the hypothesis that the "probable driving force of living organisms must be either electrical or chemical energy, or a combination of both."

Although the theory that life is a form of energy is not new, the view Dr. Crile advances that life is essentially a result of oxidation depending upon the generation of electric charges in the cells of the organism is distinctly novel. He conceives the cell as a kind of voltaic cell in which the nucleus is the positive element, the cytoplasm the negative, basing his conclusion on the fact that the nucleus is comparatively acid, the cytoplasm comparatively alkaline, whilst the two are separated by a semi-permeable membrane, thus essentially forming an electric cell.

The author, in developing his theory, supposes the unit cells to be sequentially but rapidly charged and discharged, also that the brain is at highest potential, the liver at lowest, the electric current thus flowing from brain to liver completing the circuit by way of the fluids permeating the body.

From this conception of the phenomenon of life Dr. Crile proceeds, after a consideration of previously-conceived theories or established facts regarding certain electrical processes in the organism, to interpret protoplasm in the light of his theory, and thence to apply it to the functioning of certain organs, as well as to the interpretation of clinical phenomena, of cancer, and of processes of reproduction.

If we consider life as a molecular, or atomic, function, as we are bound to do by the exhibition of metabolism when life is present, then we must also consider it to be an added something which the molecule or the atom has acquired—a force awakening the molecules of the organism to active chemical energy. Dr. Crile assumes this force to be electrical energy generated in the organism itself, but there is the possibility that life may be a distinctive form of energy, a phenomenon of specific electro-magnetic aether waves capable of electrical effects. In any case, the work is a notable contribution to an abstruse subject.

Any suggestion of the fantastic is removed by the able manner in which the theory is developed with the aid of deductions from a great number of experiments that are given in detail in an extensive appendix, together with a valuable bibliography.

H. C. T. G.

Early Medical and Biological Science. By R. T. GUNTHER, M.A., LL.D., F.L.S. (Oxford University Press. 7*s.* 6*d.*).

If that elusive individual "the average man" were asked to say what he associated with Oxford, he would certainly not reply "science." Nevertheless, Dr. Gunther's book of 246 pages is a condensed record of scientific work done at Oxford during eight hundred years. The title scarcely informs us of the wide range of the contents which are dealt with in the seven chapters, namely—Early Medicine; Medicine in the Seventeenth Century and after; Anatomy; Physiology; Zoology; Botany; and Geology.

To the serious student of the history of biology in England the book is invaluable providing, as it does, with all conscientiousness, numerous references to the original sources. But the treatise is far removed from a mere catalogue of the doings in Oxford laboratories of a past day; it is a pleasantly written account of the achievements of Oxford men of science, as well as a sketch of their personalities. Thus we get a glimpse into the tavern life of the worthies of a former day in the ancient city. Not many students realize how interested in *vital* problems were the early Oxford naturalists. Boyle, for instance, the "father of chemistry," who coined the word "barometer" and is eponymous for his "law," was the first investigator to show by means of the air-pump that in the vacuum of that apparatus the flame of a candle went out and a small animal died. He wrote a long treatise on "humane blood." Dr. Richard Lower, of Christ Church, introduced the practice of the transfusion of blood from one animal to another—a procedure which fell into disuse only because not until our own day did men understand the precise causes of the occasional failures and fatalities arising from the mixing of physiologically different types of blood.

The clinical thermometer was first described in England at a meeting of the Oxford Philosophical Society on 13th May, 1684. Mayow's pioneer work in physiology at Oxford is very well known. Not everyone, however, is aware that Christopher Wren, before he turned his attention to architecture, studied physiology and medicine at Oxford in a perfectly serious manner. Some of his recorded experiments involved considerable attainments in technique, for he injected drugs into the veins of animals. The chapter on anatomy at Oxford is a revelation as to the amount of careful observation carried out by Joliffe, by Highmore of Trinity, eponymous for the maxillary antrum, and by Willis, eponymous for the circle, the plates for whose "Anatomy of the Brain" were drawn by Wren himself. In the chapter on medicine we meet with such names as Sydenham of Wadham—the "English Hippocrates"—John Locke, M.B., better known as the philosopher, Radcliffe, Oxford's great benefactor, and Matthew Baillie, nephew of the celebrated John Hunter. There is no index, but the illustrations are valuable and interesting; it is a book to read, to re-read, and to cherish.

D. FRASER HARRIS.

From Tribe to Empire: Social Organization among Primitives and the Ancient East. By A. MORET and G. DAVY. "History of Civilization" Series. (Kegan Paul, Trench, Trubner & Co. 16*s.*).

In certain respects, but certainly in its method, this volume is as interesting as any that has yet appeared in the "History of Civilization" Series. It is an attempt to remedy the defects of the historical record, which even in Ancient Egypt and Chaldaea do not tell us what was the earliest form of social institution. The authors would fill the gap by analogies drawn from the material of comparative sociology. In tracing the development of the empires of the Ancient East from their tribal origins to their highest point as world powers, they first explore the culture of primitive peoples. They review the totemic clan organization to show how the power or mana, originally immanent in every member of the group through a mystic connexion with the totem, is gradually individualized until it gives rise to a kingship which unites the sacred character of all the gods of the country, and holds all their wealth and magic power. The institutions of Egypt and Mesopotamia are then surveyed from the earliest times for survivals which point to institutions analogous to those already noted among primitive peoples. Lastly, the authors follow the growth of the first empires of the Orient and show how, running like a thread through their history, is still immanent the same mystic conception that animated the clan. Without entering upon a detailed discussion of the archaeological data and their interpretation, it may not be out of place to offer a general observation on the question of method. It was for long taken as almost axiomatic in anthropology that the culture of modern primitive peoples might be used to interpret the data of archaeology. So far as technology is concerned normally this holds good. When we pass to inferences that may be drawn as to institutions and beliefs, some caution must be exercised in judging how far the analogues are to be regarded as really primitive. As the researches of Rivers in Melanesia and investigations among the Australian aborigines have shown, it cannot be assumed that a primitive culture in isolation has necessarily remained static. In so far the argument from the primitive to the primal may be vitiated.

E. N. F.

The Case against Evolution. By GEORGE BARRY O'TOOLE, Ph.D., S.T.D. (The Macmillan Co., New York. 1926. 7*s.* 6*d.*).

Professor O'Toole has held Chairs of Theology and Philosophy at St. Vincent Archabbey and of Animal Biology at Seton Hill College, and his training and teaching must have covered a wide area.

Our author is of opinion that the philosophers and "scientists" of to-day are so intent on making out a plausible case for the Theory of Evolution, that they take little or no interest in the facts which are opposed to it. These facts, he considers, they always minimize, and in his present work he aims at setting

forth that side of the question which he considers it is now the fashion to suppress. According to him evolution has risen to the heights of a dogma, but he finds the safest attitude towards evolution to be an agnostic one.

The Professor is evidently a learned man, and writes with ease and with much plausibility. He has seized hold of all the difficulties which naturalists have pointed out in tracing the evolution of living organisms—such, for instance, as the incompleteness of the palaeontological records—and all these he emphasizes. He further lays considerable stress on the divergent views of various writers on heredity and animal pedigrees. He thinks, as Oliver Wendell Holmes says of the privately interpreted bible, that readers take from it the views that they brought to it. He makes a good deal of those very positive gentlemen who dominated biological science in the last half of the nineteenth century: men like Huxley, Tindall, and Haeckel, and he is particularly hard on that wonderful old man Charles Darwin who, like Sir Joseph Hooker, only sought after truth in a humble-minded way and never complained even of the bitterest attacks. He even drags in that "old, old story" of Darwin having given up reading poetry as he advanced in years, but one is rather inclined to wonder whether Professor O'Toole ever began to read poetry. The rhymed samples he gives in his book makes one doubt.

The worst feature of the work is that there is so little construction in it, and it is difficult to find out clearly what the author really means. Perhaps the following sentence with regard to the origin of life is as typical as any we can quote:—

"Nor, finally, is there any warrant for regarding such an initial vivification of matter as supernatural. Only that is supernatural which transcends the nature, powers, and exigencies of all things created or creatable. But, as we have seen, if life was to exist at all, a primal animation of inanimate matter by Divine power was demanded by the very nature of things. Here the Divine action put forth in response to an exigency of nature and terminated in the constitution of living nature itself. Now, the effect of a Divine action, by which the natures of things are initially constituted, plainly pertains to the order of nature, and has nothing to do with the supernatural. Hence the primordial constitution by Divine power of living nature was not a supernatural but a purely natural event."

"Another way," as the cookery books say, is that of the Bishop of Birmingham, who in a recent sermon stated "He was convinced that we could not reject the conclusions of experts working with a single-minded devotion to truth. To do so was to make religious faith seem incompatible with thoughtful inquiry. And, if often the conclusions of experts were probable rather than certain, we could not build on beliefs which always needed the benefit of the doubt."

Professor O'Toole is evidently not in agreement with the Eastern proverb which states that the "ink of science is more precious than the blood of the martyrs."

Books Received.

Tungsten: A Treatise on its Metallurgy, Properties and Applications. By COLIN J. SMITHELLS, M.C., D.Sc. (Chapman & Hall Ltd. 21s.).

Journal of the British Science Guild. August, 1926. No. 22. (1s.).

The Week. By F. H. COLSON, M.A. (Cambridge University Press. 5s.).

Our Mobile Earth. By REGINALD A. DALY. (Chas. Scribner's Sons. 21s.).

Evolution and Religion in Education. By HENRY FAIRFIELD OSBORN, LL.D., Sc.D. (Chas. Scribner's Sons. 7s. 6d.).

A Catalogue of British Scientific and Technical Books. Supplement, 1925. Arranged by DAPHNE SHAW. (British Science Guild).

Gum Arabic. By H. S. BLUNT, M.A. (Oxford University Press. 10s. 6d.).

Modern Psychology and Education. By MARY STURT, M.A. and E. C. OAKDEN, M.A. (Kegan Paul, Trench, Trubner & Co. Ltd. 7s. 6d.).

Elysia: A New Philosophy of Happiness. By ALBERT LUC. (Watts & Co. 3s. 6d.).

The Early English Tobacco Trade. By C. M. MACINNES. (Kegan Paul, Trench, Trubner & Co. Ltd. 7s. 6d.).

Collins' New Books. Autumn, 1926. (W. Collins, Sons & Co. Ltd.).

Picture Postcards. Sets D 9 and 10, H 3. (Famous Naturalists and Crystals.) (British Museum—Natural History. 1s. a set).

The Memory Factor in Biology. By PROF. C. J. PATTEN, M.A., M.D., Sc.D. (Bailliere, Tindall & Cox. 5s.).

Light and Health. By M. LUCKIESH and A. J. PACINI. (Bailliere, Tindall & Cox. 22s. 6d.).

Naturalist's Guide to the Americas. Edited by VICTOR E. SHELFORD. (Bailliere, Tindall & Cox. 45s.).

Stanley Paul & Co.'s Announcements. 1926-1927.

Messrs. Methuen's Illustrated List of Announcements of Forthcoming Books for the second half of the year.

Procrustes, or the Future of English Education. By M. ALDERTON PINK, M.A. (Kegan Paul, Trench, Trubner & Co. Ltd. 2s. 6d.).

Holism and Evolution. By GENERAL THE RIGHT HON. J. C. SMUTS. (Macmillan & Co. Ltd. 18s.).

Books on all Technical Subjects and Applied Science. Catalogue. Dept. No. 7. September, 1926. (W. & G. Foyle Ltd.).

The Conservation of the Family. By PAUL POPENOE. (Bailliere, Tindall & Cox. 13s. 6d.).

Winter Blossoms from the Outdoor Garden. By A. W. DARNELL. (L. Reeve & Co. Ltd. 21s.).

Popular Experiments in Dynamics. By GEORGE C. SHERRIN. (George Philip & Son Ltd. 2s.).

Science Progress. No. 82. October, 1926. Vol. XX. (John Murray. 7s. 6d.).

The Education Outlook. October, 1926. Vol. 78. No. 10 (6d.).

Decennial Index of the Analyst. Vols. XLI-L. Compiled by M. B. ELLIOTT, M.B.E. (W. Heffer & Sons Ltd. 21s. Cloth, 25s.).

Chemistry in the World's Work. By HARRISON E. HOWE. (Chapman & Hall Ltd. 15s.).

Tonality: Its Rational Basis and Elementary Development. By JOHN L. DUNK. (Published by the Author. 3s. 6d.).

R. D. Report. No. 68. "Portable X-ray Equipment." Research Dept., Woolwich, 1926. (H.M. Stationery Office. 1s. 6d.).

An Adventure in Moral Philosophy. By WARNER FITE. (Methuen & Co. Ltd. 10s. 6d.).

The Journal of the Royal Anthropological Institute. Vol. LVI. 1926. January-June. (The Institute. 15s.).

The Future of Futurism. By JOHN RODKEN. (Kegan Paul, Trench, Trubner & Co. Ltd. 2s. 6d.).

The Nature of the World and of Man. Editor, H. H. NEWMAN. (Cambridge University Press. 20s.).

Maori Symbolism. By ETTIE A. ROUT. (Kegan Paul, Trench, Trubner & Co. Ltd. 21s.).

Junior Technical Electricity. By ROBERT W. HUTCHINSON, M.Sc., A.M.I.E.E. Second edition. (University Tutorial Press Ltd. 4s. 6d.).

The Sailing-Ship. By ROMOLA and R. C. ANDERSON. (Geo. G. Harrap & Co. Ltd. 10s. 6d.).

Psychology and Ethnology. By W. H. R. RIVERS, F.R.S. (Kegan Paul, Trench, Trubner & Co. Ltd. 15s.).

Towards the Answer. By C. R. BOYD FREEMAN. (J. S. Reynolds. 4s. 6d.).

NOV 29 1